varieties of corn sometimes cultivated on farms in New England and the middle states. Where a single variety has been cultivated for a man's lifetime in the same neighborhood, or even on the same farm, each year the seed having been carefully selected and prepared until no further improvement is reached by such selection, there it often happens that such home-bred local variety yields better than any variety introduced from without. But it also happens that, having been so long purely bred, it is of especial value in mixed planting, as already described. Further illustrations of regional influences will be given under the special grains.

The tables of cereal production by physical moments (as temperature, rainfall, and elevation), appended to this report, will furnish the data for the after study of the relations between the production of each grain and the separate physical conditions which together constitute "regional influence". Such data have not heretofore existed. This work of Mr. Gannett is in a new direction; nothing of the kind, or even similar to it, has been done before, either in this country or elsewhere, on any such scale. The care with which these tables have been prepared, the magnitude of the facts thus tabulated, the nature of the conditions and details involved, give them an especial interest in this connection, and they promise to be of vast economic importance in enabling us to study, as they never could be studied before, the relations between special varieties and the physical conditions under which they attain their greatest excellence. It is eminently probable that further study and future observations in this direction will disclose relations between certain varieties of grains and the physical conditions of the several grain-growing regions which will result in a more intelligent selection of seed for a change and explain many anomalies observed by farmers, some of which will be noticed under the respective grains.

Another reason why change of seed is sometimes beneficial is that the diseases which afflict our crops, and the insects which prey upon them, prefer some varieties to others, and the diseases or the insects will become most abundant in those localities where the varieties they prefer are most cultivated. If, then, a new variety is introduced, even of itself no better in other respects than the old one; if it be less liable to mishap by insect or by disease, there is an advantage in introducing it. Other reasons of less significance exist, which will be noticed in their appropriate places.

Questions 40, 91, 119, 120, 121, and 122 of the special schedule relating to cereal production were especially directed to elicit information regarding the experience of farmers in respect to change of seed, the results of which inquiries will be discussed in their appropriate places.

We have so many cases where varieties of grain may be profitably grown with a frequent change of seed in regions where the varieties cannot be maintained without such change, the cases are so numerous, so marked, and the deterioration is so certain, that many farmers have come to believe that it is a law of nature that varieties will ultimately run out in every place if the seed is not changed. This subject has already been discussed, but we will repeat in this connection that there is no reason in nature why a variety should run out any more than why a natural species should run out or a breed of animals run out. We know of no reason why it should run out in a region to which it has been specially adapted, or where it originated, if the cultivation of the crop and the selection of the seed be maintained. Some varieties we know are very old, where artificial cultivation and selection have as really adapted the variety to a region as nature has adapted her species to their regions. The King Philip corn is believed to retain still the characters it had in the earliest days of the New England settlements.

PHYSICAL AND CHEMICAL CHARACTERS.

RELATIONS OF GRAIN TO MOISTURE.

All growing plants contain water in large quantities as a necessary constituent of growth. We have no full and continuous series of determinations of the amount of water in the cereals while still growing, and in the milk and in the dough, but all farmers are familiar with the fact that they are then soft; that as ripening goes on the juiciness of the kernel diminishes; and that finally, in our eastern climates, even when the grain is fully ripe, it is still so moist that it must be further cured before it can be safely thrashed and stored in granaries. But, however well dried in the air, all cereals still contain water, although they may appear dry and hard. When damp grain is exposed to dry air, the rapidity with which it dries and the amount of moisture which will remain in the grain after drying depend upon the dryness of the air and on the temperature at which the process goes on. In making chemical analyses of grains, flour, and the like, the amount of water is determined by drying the material at the temperature of boiling water or above. Some chemists dry at 212° F. (100° C.) until the grain ceases to diminish in weight at that temperature, others using a somewhat higher temperature. The conditions used in the analyses made for the Census Bureau were that the drying was done in a vacuum and at a temperature of 230° F. (110° C.).

All the commercial grains, then, as dried for market, contain a considerable but a variable amount of moisture. The tables of chemical analyses of American grains appended to this report show the amount found by the chemists in the samples of grains as they came into their hands. These tables extend to upward of two hundred analyses of grain in the kernel, and the average amount of moisture (or "water", as it is called in the analytical tables) is about 11 per cent.; the range, however, is large, running from about 4 per cent. to nearly 21. Great as is this range, the actual variation or range of the amount of moisture in commercial grains is undoubtedly considerably greater. There has never been any direct determination of the amount actually existing in the drier grains in the central valley of California, where, as is well known, grain becomes exceedingly dry in summer; nor, on the other hand, has there ever been any determination of the greatest amount that grain may contain and still be dry enough for purposes of shipment or of grinding. It is known that corn, as it comes to market, has sometimes 20 per cent. of water. As it comes into the hands of the chemist for analysis, it generally happens that it is selected grain of excellent quality, very frequently having been put up in small samples, and possibly kept in dry rooms for some time; it is therefore very frequently dried much beyond the point at which most of the grain is sold in the markets. When moist grain dries, its ultimate dryness depends upon the temperature and the dryness of the air. It continues to lose in weight more and more slowly, until a point is reached where there is no further loss, although there still remains several per cent. of moisture in the grain, unless it be driven out by a heat equal to that of boiling water.

HYGROSCOPIC CHARACTERS.

In common with most other vegetable substances, grain is hygroscopic, the amount of moisture contained in it depending upon the dryness of the air, the dryness of the grain fluctuating with its dryness, so that when moist grain is put in dry air it loses a part of its moisture and shrinks in bulk and in weight, and when dry grain is put in moist air it then absorbs water from the atmosphere and gains in weight and in bulk; if the air again dries, the grain again loses weight, the weight of the grain at any time being related to the moisture in the air which surrounds it. No matter how old or how new the grain is, it may be kept year after year, increasing in weight whenever the air is damp and moist and diminishing again whenever the air is dry, and these fluctuations in its weight, so far as we know, go on indefinitely; they certainly do for several years.

This subject has attracted but little attention in the Atlantic states, but has been the subject of much discussion and of some experiment in California, where it is a matter of relatively greater importance. The most of the grain of that state is raised in the interior valleys, and is generally stored there for a time before shipment. In those valleys the air is intensely dry during the summer season, and the grain loses nearly all of its moisture; and when this grain is removed to the damp warehouses about the bay of San Francisco, or is shipped to a foreign port in the hold of a vessel in which the atmosphere is nearly saturated with moisture, the weight very materially increases. It has been stated that "this increase will sometimes pay the entire cost of freight from San Francisco to Liverpool".

The actual amount thus gained has been the subject of newspaper discussion from time to time in that state, and to throw light on the matter Professor Hilgard, of the University of California, directed a series of experiments, which were conducted by Mr. Edmond O'Neill, of the Agricultural College of that university, who made it the subject of his graduating thesis, and an abstract is published in the *Supplement to the Biennial Report of the Board of Regents* of the university, of 1879, page 110.

His method was this: The dried grain was spread out in a very thin layer upon a small table, standing in shallow water and covered with a bell-jar. To make the air within this space as nearly saturated as possible, filter paper, dipping into the water below, extended to near the grain, but not touching it; the whole was kept at a temperature of about 64.4° F. (18° C.), and the grain was weighed from time to time in a corked flask to prevent loss during the weighing. Under such circumstances grain would continue to absorb moisture and increase in weight from twelve to eighteen days, the absorption being accompanied by an increase of bulk, which was not measured. The gain in weight from such absorption was as follows: In eighteen days oats gained 19.8 per cent.; barley, 20.4 per cent.; and in fourteen days wheat gained 18.8 per cent. In all cases the increase was very rapid at first, then slower and slower, until about the thirteenth or fourteenth day, when a sudden increase occurred, due to the development of mold caused by the great amount of moisture present. Nearly half of the total increase occurred in the first twenty-four hours, and the progress during the whole period may be seen in the tables cited.

He also exposed air-dried grain to an absolutely dry (artificially dried) atmosphere at the same temperature, and for the same period, eighteen days. The loss was at first very rapid, then slower and slower, but continuing for the whole period, amounting in eighteen days to 9.3 per cent. for oats, 7.8 per cent. for barley, and 6.2 per cent. for wheat.

According to these determinations, perfectly dry grain (artificially dried), exposed to a saturated atmosphere at a temperature of 64.4° Fahr. (18° C.) for eighteen days, will increase in weight as follows: Wheat, 25 per cent.; barley, 28.2 per cent.; oats, 29.1 per cent. As the temperature of the interior of that state in summer is about 80° F., experiments were made in drying grain at that temperature; and as the temperature increased, the amount of moisture thus lost in a given time also increased. Wheat dried in an artificially prepared atmosphere, believed to be about as dry as that which naturally occurs at harvest in the interior valleys of the state, led to the belief that the wheat cured there in the fields at harvest time becomes nearly as dry as it would in an absolutely dry air, and "on transporting to a temperate climate may possibly increase 25 per cent., while a gain of 5 per cent. to 15 per cent. may be looked for with almost absolute certainty". The profit of this gain in weight accrues to whoever owns the grain when this absorption is going on. When the farmer sells his grain by weight in those interior valleys, then this profit accrues to the commission merchants or dealers who own it between the time it leaves the ranches and the time when it is weighed in the foreign ports where delivered.

The atmospheric conditions in the Atlantic states are very different from those of California, but as the same law of nature operates similar changes occur. Because of the commercial importance of this subject, and the lack of knowledge as to the amount of water that commercial grains can or will absorb or lose during transit and handling in our climate, a series of experiments was begun by me in March, 1880, and before I was aware of those being made in California under the direction of Professor Hilgard. My method is this: Samples of grain of various kinds are kept inclosed in paper boxes, and the grain itself is carefully weighed from time to time on a chemical balance, with all the precautions to secure accuracy. The boxes containing the grain are but partly filled, and are kept in a basket suspended from the ceiling in my office, a second-story room, where the air of the room freely circulates about it. The temperature and the moisture of the room during the time of the experiment has been in winter that of an ordinary furnace-heated house in New England—a condition where the air is drier than in the warehouses, but not drier, probably less dry, than in the valleys of California in the time of harvest, and perhaps not much, if any, drier than occurs in the heated harvest fields of the Mississippi basin. The windows of the room were kept open during the summer and until the building was heated in the fall. New Haven is a seaport, and the air, although moist in summer and autumn, is not nearly so moist in such a room as it is in many places where grain is stored after it leaves the farm and before its shipment, certainly not so moist as the hold of a ship during its voyage. The samples exposed to these conditions were repeatedly weighed at various seasons of the year. Some varieties were also exposed to air dried over strong sulphuric acid in a desiccator, such as is used in chemical laboratories, and left standing in the sun for two months in summer, and a few samples of wheat still further dried (as it is in chemical analysis) in a vacuum at 230° F. (110° C.).

The samples were put in the boxes and the experiments begun in the early spring of 1880, when the most of the grains were thoroughly air-dried by being kept in the house the previous winter. They gained as warm weather went on from 2 to 5 per cent., according to their dryness when put up. They were not weighed between June 1 and September 10 of that year, and it is possible that they may have been heavier at some date in the interval than when weighed at the latter date, which represents the greatest weight in the summer of 1880. From this time their weights diminished until February, 1881, then fluctuated somewhat when near the minimum (and indeed they fluctuated all the time with each change of weather), and then increased again, attaining a maximum late in August or early in September of 1881. It will be remembered that this last date was in a period of unusual heat and drought over the whole region from the great plains eastward to the Atlantic. This severe drought existed at New Haven, and therefore the maximum weight reached was in a "very dry time", with the specimens inclosed under conditions like those pursued by seedsmen for the best protection of seeds from undue moisture without actual exclusion from the air.

It must be remembered that the term "dry air", as ordinarily used, is a relative term, not depending on the actual amount of moisture in the air, but the amount as related to its temperature. Air as moist as it can be is said to be *saturated*, and the amount of moisture required for saturation increases rapidly with the temperature. I may say, in a general way, that it doubles with each rise of 15° F. of temperature; that is, at 90° air will hold about twice as much moisture as at 75°, nearly four times as much as at 60°, and more than seven times as much as at 45°. Therefore, air moist to saturation at 60°, if heated to 75°, is then only half saturated, and seems dry; and if further heated to 80° or 90°, it then seems very dry indeed, although it contains as much water as air saturated at 60°. Hence, when warm air is moist, it contains very much moisture, and dry grains readily extract some from such air.

The accompanying table shows the relative weights of the several samples of grain in the moist air of late summer and the dry air of a furnace-heated office in winter. The table embraces forty samples in all (numbered for convenience of reference), representing several varieties of each of the grains, and from various parts of the country. They also represent various grades and qualities. For example, the wheats 1, 2, 3, 10, and 11 are very plump, and the sample No. 4 is very badly shrunken. Of the corns, No. 17 has grains eleven times as large as those of No. 12, and various other characters are represented. Twenty-two of the samples are from the lots that were analyzed, and the numbers are given in the second column of the table under which they occur in the tables of chemical composition. Columns 3 and 4 give the variety and place where grown.

The fifth column gives the year of the crop. It will be seen that all the specimens except two had been dried over one winter before the experiments began; some of the grains were three years old, and one specimen of corn four years old.

The sixth column shows the weight in early autumn of 1880. During the summer all the specimens had gained in weight, some of them nearly 6 per cent., others less, according to the way they had been kept the previous winter.

The seventh column represents the least weight in the dry air of winter, and all the other weights are calculated from this as a standard. They had lost about 6 per cent. since the previous summer.

The eighth column shows the weight in the late summer of 1881, when the specimens had gained from 6.8 to 8.4 per cent. It is somewhat remarkable that all the samples lost and gained so nearly alike when we consider the variety of the samples, but the uniformly large gain in the moist air of the seaport is very suggestive, and illustrates how grain dried in one climate may gain in another, or how it may lose and gain in the same climate where the air has access to the whole of the mass.

The ninth column shows the weight as dried in a desiccator from one hundred to one hundred and thirty days. The weight would be reduced by a longer exposure to this artificially dried air, for the specimens have continued to lose so long as the experiment has been going on, very slowly at last; yet the loss does go on, and illustrates the extreme tenacity with which the grain clings to some moisture. In fact, it continues to hold some, despite such drying, as is shown in the next column.

The tenth column shows the ultimate weight when dried in a vacuum at 230°, until there is no further loss in weight.

The experiments of Professor Hilgard, already cited, show the rapidity with which very dry grain absorbs moisture from an artificially saturated air the first few hours of exposure. I varied the experiment, and several specimens of wheat, dried in a desiccator for fifty-one days, until they weighed 6 or 7 per cent. less than the lowest air-dried weight in the tables, were then weighed in a tight metallic vessel, and then spread out on sheets of white paper on the sill of an open window, in free access of air, on a warm, muggy day, when the temperature was 77.2° and the wet-bulb 75°, and after a few minutes weighed again with the same precautions. One specimen of the wheat gained 0.19 (about one-fifth) of one per cent. in three minutes, another 0.35 per cent. in six minutes, another 1.64 in twenty-four minutes, and another 2.02 per cent. in fifty-four minutes. These illustrate strikingly the amount of absorption that may take place during even rapid handling, and the rapid change that sometimes occurs in hot, muggy climates. The converse is, of course, true, and based on it are the means of rapidly drying too moist grains by agitation in air dried by artificial heat.

TABLE XXIV.—LOSS AND GAIN IN WEIGHT OF GRAIN DUE TO SPONTANEOUS LOSS AND GAIN OF MOISTURE.

No.	Corresponding analysis number.	Grain.	Where grown.	Year of crop.	Weight, September, 1880.	Weight, February, 1881.	Weight, September, 1881.	Weight, dried in desiccator.	Weight, dried at 230° F.
		WHEAT.							
1	....	Little Club, winter	Oregon	1877	105.9	100	108.4	94.8	....
2	....	White Club, winter	....do	1877	105.8	100	108.4	....	....
3	....	Australian, winter	....do	1877	105.9	100	108.3	94.5	....
4	....	Badly shrunken, winter	California	1880	107.3	100	107.7	94.8	....
5	....	Somewhat shrunken, winter	....do	1880	107.4	100	108.2	92.7	....
6	....	Milwaukee Club, winter	"Western"	1877	105.8	100	108.4	94.9	....
7	57	Red Winter, No. 2	....do	1879	106.1	100	108.2	94.1	92.5
8	42	Red Winter	New York	1879	106.2	100	107.7	93.0	91.5
9	21	White Winter	....do	1879	106.2	100	108.3	93.9	92.3
10	....	Sonora Spring	Oregon	1877	105.8	100	107.9	94.9	91.6
11	....	White Australian, spring	....do	1877	105.9	100	108.0	94.5	....
		CORN.							
12	145	An 8-rowed White pop-corn	Connecticut	1876	105.9	100	107.1	95.6	....
13	178	Pop, Yellow and White mixed	New York	1879	106.0	100	107.2	....	....
14	154	Waushakum	Massachusetts	1879	106.1	100	107.2	....	....
15	....	Wisconsin Dent	Connecticut	1878	105.7	100	107.3	....	....
16	....	Black Sweet	....do	1878	105.6	100	107.8	....	....
17	....	Cuzco	Peru	1879	107.9	100	107.6	....	....
		OATS.							
18	....	Potato (very heavy)	Oregon	1877	105.1	100	106.7	....	....
19	....	Surprise (very heavy)	....do	1877	105.1	100	106.9	....	....
20	284	Common (38 pounds per bushel)	Michigan	1879	105.7	100	107.7	....	....
21	....	Common (34 pounds per bushel)	New York	1879	105.5	100	107.3	....	....
22	275	Common	Connecticut	1879	105.4	100	107.1	....	....
23	277	Common	....do	1879	105.6	100	107.3	....	....
24	286	Common (32 pounds per bushel)	New Hampshire	1879	105.4	100	107.3	....	....
		BARLEY.							
25	....	Oregon	Oregon	1877	105.2	100	107.2	....	....
26	306	4-rowed	New York	1879	105.6	100	108.0	....	....
27	307	2-rowed	....do	1879	105.8	100	107.6	....	....
28	303	2-rowed	Massachusetts	1879	105.7	100	107.8	....	....
29	304	Common	New Hampshire	1879	105.5	100	107.7	....	....
30	308	4-rowed	Canada	1879	105.6	100	107.6	....	....
		RYE.							
31	322	Common	New Hampshire	1879	105.9	100	108.2	94.6	....
32	....	Common	North Carolina	1879	107.9	100	107.9	....	....
33	....	Common	....do	1879	108.2	100	107.8	....	....
		BUCKWHEAT.							
34	331	Silver Hull	Connecticut	1879	106.1	100	107.8	....	....
35	333	Silver Hull	Massachusetts	1879	106.0	100	107.9	....	....
36	334	Silver Hull	Minnesota	1879	105.8	100	107.9	....	....
37	338	Silver-gray	New York	1879	106.3	100	108.2	....	....
38	335	Silver-gray	New Hampshire	1879	106.1	100	107.9	....	....
39	332	Common Gray	Connecticut	1879	106.0	100	107.2	....	....
40	....	Common	North Carolina	1879	108.5	100	108.0	....	....

CHEMICAL COMPOSITION.

The economic value of the cereals, whether used as food for man and his animals or as a raw material for the manufacture of commercial products (as starch, glucose, spirits), depends ultimately on their chemical composition. Their market value, however, is always modified by certain physical characters which affect their appearance or the appearance of their product. The most familiar illustrations of this are of wheat and barley. First-class wheat depends on the color and the appearance of the flour it will make rather than upon its chemical value as a sustainer of life; and the barley of certain regions, equally nutritious as food for animals, is nevertheless very much deteriorated in price if its malt imparts undesirable colors to the beer made from it.

Of the ultimate chemical compounds found in our cereal grains, and which may be represented as distributed in classes, there is an indefinite number. The analyses that have been made have been mostly for determining economic questions rather than purely scientific ones, and usually to test the relative values of grains or their products for food or to regulate certain processes in the manufacture of millstuffs. In most cases an analysis giving the relative quantities of six classes or groups of substances is sufficient for a general understanding of the composition of the grain for actual use. These substances, or groups of substances, are as follows:

First: *Carbhydrates*—Starch, sugar, gum, and such similar compounds as resemble them in chemical composition and in digestibility and the ease of chemical decomposition. These amount to from 62 to 79 per cent. of the whole grain, according to the species or variety.

Second: *Fat*, which includes all the oils and fatty matters of whatever kind, and also vegetable wax, which closely resembles the oils in chemical composition. These substances are found in all the cereals in quantities from 1.26 per cent. in some kinds of wheat to 9.31 in the richer kinds of corn. In corn it exists more largely in the germ than in the body of the grain, and this is also probably true of the other grains.

These two classes are together often called the "elements of respiration" and "fat-producing elements", these and similar terms expressing in a measure their functions as food.

Third: *Fiber*, which constitutes the least valuable part of the grain. Although somewhat analogous to starch, gum, and sugar in its ultimate chemical composition, it differs greatly from them in digestibility and in the ease of chemical decomposition, more nearly resembling wood in its characters. Consequently, it is often called "woody fiber". Some chemists speak of it as "cellulose", others as "crude fiber". It constitutes from 1.17 per cent. in the thinner-skinned wheats to 13 per cent. in the lighter oats.

Fourth: *Albuminoids*, or substances containing nitrogen in nearly the same proportion in which this element is found in the lean flesh of animals. In food these albuminoids are often spoken of as the "elements of nutrition" and "flesh-forming" compounds, because they go to the production of animal muscle, and they are the most costly elements of vegetable food. They range in the analysis of the whole grains from 7.5 per cent. in the poorest corn to 15.5 per cent. in the richest wheat, ordinarily ranging from 10.5 to 11.5 per cent. In rice the quantity is considerably smaller, amounting to an average of less than 7.5 per cent.

Fifth: *Ash*, or the earthy part, drawn originally from the soil, and which amounts to from 1 to 3.5 per cent. in different samples and kinds of the grain. This varies considerably in samples of the same grain, and as it is drawn from the soil, and not from the atmosphere, constitutes the truly exhausting agent, and its removal is the great source of deterioration by long-continued cropping to grain without adequate manuring.

Sixth: *Water*, which constitutes from 5 to 20 or more per cent. of grains as they come in the market. The amount is exceedingly variable, and probably in some of the damper shipments amounts to even more than the larger figures here given, the very driest, however, probably rarely lower than the smallest figures here given. The probabilities are that it is usually from 9 to 18 per cent. Because of the extreme variability in amount, depending on the comparative dryness of the grain, and even upon the season of the year, when we wish to compare the values of the other ingredients for feeding or for manufacture this one is usually left out in the calculation.

In the tables of chemical analysis we have therefore the two parallel series: in one the composition of the grains is given, with the amount of water actually found by analysis; in the other (under "calculated water free") the percentages are calculated independent of the water, giving merely the relative quantities of the other ingredients compared with each other.

Because of the economic importance of the subject the chemical composition of grains and their products has attracted considerable attention in late years, and since the methods of chemical analysis have become reasonably accurate and reliable a very considerable number of analyses of American cereals has been made. No comprehensive series had, however, ever been attempted, and the literature of the subject was so scattered through many publications as to be practically unavailable for comparison by the average user, until, in 1879, Dr. E. H. Jenkins, of the Connecticut Agricultural Experiment Station, carefully collected all the analyses of American grains, millstuffs, and fodder material which had been published up to that time, which were complete enough for comparison, and which were considered by him to be reliable. These were classified, tabulated, and published in the *Annual Report of the Connecticut Agricultural Experiment Station for* 1879 (New Haven, 1880), page 132. This valuable table, while it threw much light on the composition of American grains, also showed how incomplete our series of analyses were.

There were but two analyses of American oats, one each of rye and barley, none of buckwheat, and none of the flour or food preparations of either oats, barley, rye, or buckwheat of American growth. Of corn and wheat there were many analyses, but they represented comparatively few localities. It has long been a popular belief that the qualities of flour and the products prepared from grain grown in different sections of country have different properties, which are based upon a difference of chemical composition, and that this difference of chemical composition is due to the influence of the locality itself where the crop was grown. For example, the statement so often found in speeches and in journals that corn grown in the South is more nitrogenous and more nutritious than that grown in the North, and that western wheat contains more gluten than eastern, are pure assumptions, based upon no accurate and wide chemical investigation. Considering the intrinsic interest of the subject itself, the abundance of loose assertion having no basis in exact knowledge, and the importance of having at least some of these gaps filled, I have had one hundred and five additional analyses of American grains and their food products made under my direction, by Mr. Samuel L. Penfield, in the laboratory of the Sheffield scientific school of Yale College. These analyses were all made in duplicate to increase their accuracy, and the percentages given are the averages.

In choosing the samples for analysis some were taken of special varieties and of known origin; others were of certain grades as officially inspected; others were bought of salesmen in the open markets. The same may be said in respect to the mill products, some of which were obtained direct from the manufacturers, and others bought where they were on sale in the markets by reputable dealers. This method was adopted that the analyses might represent the materials as they came to the consumers, and thus escape the suspicion that they might be exceptional samples chosen by interested parties. All are of the crop of 1879 unless otherwise stated.

The references cited in the tables of chemical composition give not only the original place of publication, but are often references to places where the especial analyses are more fully described, or the objects for which they were made more fully discussed.

The following are references to such published analyses of American cereals as have not been included in these tables. Some are partial analyses, and in the others some circumstance indicates that they are of no value for the present purpose:

Buckwheat—United States Patent Office Report, 1849, p. 47.
Maize—Transactions New York Agricultural Society, 1848, p. 678.
Maize—United States Patent Office Report, 1849, p. 470.
Maize—United States Patent Office Report, 1857, p. 160.
Maize—United States Patent Office Report, 1873, p. 180.
Maize—United States Patent Office Report, 1875, p. 144.
Wheat—Ohio Agricultural Report, 1857, p. 727.
Wheat—United States Patent Office Report, 1840, p. 64.

The following tables include all the completed and trustworthy chemical analyses of American cereals and their fodder products that have appeared to this time, and are grouped as seemed most convenient for the user. To the analyses of grains, mill stuffs, waste products, and so on, I have appended also such analyses of straw and the fodder materials derived from these cereals as have yet been made, and also a few analyses of miscellaneous seeds and fodder materials (as sorghum) belonging to the cereal tribe of plants and cultivated in this country. These tables, therefore, represent the present state of our knowledge of the chemical composition of American grains and their products.

EXPLANATION OF SIGNS USED IN THE TABLES.

In the analyses published here and collated from other sources the analysts in a considerable number of cases have determined separately the gum, dextrine, wax, and other constituents. In their preparation for this table, for the sake of uniformity, such analyses have been recalculated, the wax reckoned as fat (which it resembles in chemical characters) and the other ingredients reckoned collectively as carbhydrates. These analyses are marked as follows:

An asterisk (*) indicates that wax, sugar, gum and dextrine, "amylaceous cellulose," and "alkali extract" were determined.

A dagger (†) indicates that sugar, gum, albuminoids soluble in alcohol (sometimes called "Zein"), and albuminoids insoluble in alcohol were determined.

A double dagger (‡) indicates that sugar and gum were determined.

Albuminoids in all cases signify the percentage of nitrogen multiplied by 6.25.

Additional notes on some of the samples follow, indicated merely by their analysis number.

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS.

WINTER WHEAT, KERNEL.

No.	Variety.	State.	Reference.	Analysis. Water.	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
1	Polish	Maryland	†Rep. U. S. Dept. Ag., 1878, p. 147	10.08	1.67	12.43	1.56	71.59	2.67	1.86	13.82	1.73	79.62	2.97
2	White	Michigan	*Rep. Midd. Ag'l Exp. St., 1877-'78, p. 25.	12.75	1.56	11.64	1.83	70.96	1.26	1.79	13.34	2.10	81.33	1.44
3	"No. 1" White Winter	...do	U. S. Census	12.89	1.85	11.06	1.90	70.74	1.56	2.12	12.70	2.18	81.21	1.79
4	Diehl	...do	Rep. Mich. B'd Ag., 1877, p. 350	9.64	1.72	12.38	......	*a*76.26	......	1.90	13.69	......	*a*84.41	......
5	Diehl	...do	*Ibid.*, p. 351	12.18	1.82	13.78	......	*a*72.22	......	2.07	15.63	......	*a*82.30	......
6	Diehl	...do	*Ibid.*, p. 350	12.68	1.77	11.81	......	*a*73.74	......	2.03	13.54	......	*a*84.43	......
7	Diehl	...do	*Ibid.*, p. 350	10.25	1.50	11.88	......	*a*76.37	......	1.67	13.24	......	*a*85.09	......
8	Soules	...do	*Ibid.*, p. 350	11.02	1.73	11.81	......	*a*75.44	......	1.94	12.81	......	*a*84.75	......
9	Lincoln	...do	*Ibid.*, p. 350	13.38	1.56	11.90	......	*a*73.16	......	1.80	13.78	......	*a*84.42	......
10	Lincoln	...do	*Ibid.*, p. 350	10.78	1.75	11.38	......	*a*76.09	......	1.97	12.76	......	*a*85.27	......
11	Fultz	...do	*Ibid.*, p. 350	11.45	1.74	11.59	......	*a*75.22	......	1.98	13.09	......	*a*84.93	......
12	Weeks	...do	*Ibid.*, p. 350	10.03	1.59	11.00	......	*a*77.38	......	1.77	12.22	......	*a*86.01	......
13	Powers	...do	*Ibid.*, p. 350	10.85	1.70	12.03	......	*a*75.42	......	1.91	13.50	......	*a*84.69	......
14	Armstrong	...do	*Ibid.*, p. 350	12.21	1.97	12.88	......	*a*72.94	......	2.24	14.66	......	*a*83.10	......
15	Tuscan	...do	*Ibid.*, p. 350	13.77	1.72	11.37	......	*a*73.14	......	1.99	13.19	......	*a*84.82	......
16	Post	...do	*Ibid.*, p. 350	10.27	1.58	11.25	......	*a*76.90	......	1.76	12.54	......	*a*85.70	......
17	Red	Missouri	Rep. Midd. Ag'l Exp. St., 1877-'78, p. 25.	13.52	1.55	11.79	1.72	69.95	1.47	1.79	13.63	1.99	80.89	1.70
18	Yellow	...do	†Rep. U. S. Dep't Ag., 1878, p. 147	7.69	1.91	11.59	1.53	75.17	2.11	2.07	12.56	1.66	81.42	2.29
19	From limestone land	New Jersey	U. S. Census	13.30	2.09	11.39	1.90	69.62	1.70	2.41	13.14	2.19	80.30	1.96
20	From gray rock gravel soil.	...do	*Ibid*	13.67	1.82	12.50	1.93	68.34	1.74	2.11	14.48	2.24	70.15	2.02
21	White Winter	New York	*Ibid*	13.07	1.63	10.63	1.79	71.23	1.65	1.87	12.22	2.06	81.95	1.90
22	Fultz	Michigan	Rep. Mich. B'd Ag., 1877, p. 350	12.53	1.74	14.47	......	*a*71.26	......	1.99	16.54	......	*a*81.47	......
23	Treadwell	...do	*Ibid.*, p. 350	12.69	1.71	12.50	......	*a*73.10	......	1.96	14.31	......	*a*83.73	......
24	Treadwell	...do	*Ibid.*, p. 350	9.94	1.80	11.69	......	*a*76.57	......	2.02	12.99	......	*a*84.99	......
25	Treadwell	...do	*Ibid.*, p. 350	10.00	1.76	11.88	......	*a*76.36	......	1.96	13.20	......	*a*84.84	......
26	Tappahannock	...do	*Ibid.*, p. 350	11.21	1.77	13.56	......	*a*73.46	......	2.00	15.27	......	*a*82.73	......
27	Lancaster	...do	*Ibid.*, p. 350	11.93	1.82	14.00	......	*a*72.25	......	2.06	15.88	......	*a*82.06	......
28	Asiatic	...do	*Ibid.*, p. 350	11.11	1.70	12.25	......	*a*74.94	......	1.91	13.78	......	*a*84.31	......
29	Gold Medal	...do	*Ibid.*, p. 350	10.55	1.73	11.15	......	*a*76.57	......	1.93	12.47	......	*a*85.60	......
30	Gold Medal	...do	*Ibid.*, p. 350	10.12	2.00	13.06	......	*a*74.82	......	2.23	14.51	......	*a*83.26	......
31	Egyptian Red	...do	*Ibid.*, p. 350	11.48	1.69	11.19	......	*a*75.64	......	1.91	12.64	......	*a*85.45	......
32	Clawson	...do	*Ibid.*, p. 350	12.29	1.64	11.88	......	*a*74.19	......	1.87	13.54	......	*a*84.59	......
33	Clawson	...do	*Ibid.*, p. 350	11.30	1.74	10.94	......	*a*76.02	......	1.97	12.33	......	*a*85.70	......
34	Clawson	...do	*Ibid.*, p. 350	12.29	1.79	11.16	......	*a*74.76	......	2.06	12.72	......	*a*85.22	......
35	Clawson	...do	*Ibid.*, p. 350	10.36	1.64	11.81	......	*a*76.19	......	1.83	13.21	......	*a*84.96	......
36	Clawson	...do	*Ibid.*, p. 350	11.19	1.76	12.06	......	*a*74.99	......	1.99	13.59	......	*a*84.42	......
37	Clawson	...do	*Ibid.*, p. 350	11.09	1.64	12.38	......	*a*74.89	......	1.85	13.93	......	*a*84.22	......
38	Clawson	...do	*Ibid.*, p. 350	11.08	1.49	12.25	......	*a*75.18	......	1.68	13.78	......	*a*84.54	......
39	Clawson	...do	*Ibid.*, p. 350	10.43	1.70	12.69	......	*a*75.18	......	1.90	14.17	......	*a*83.93	......
40	Clawson	...do	*Ibid.*, p. 350	10.31	1.60	12.25	......	*a*75.84	......	1.78	13.66	......	*a*84.56	......
41	Clawson	...do	*Ibid.*, p. 350	13.00	1.79	11.37	......	*a*73.84	......	2.05	13.07	......	*a*84.88	......
42	Red Winter	New York	U. S. Census	13.30	1.70	13.60	1.73	68.08	1.59	1.96	15.68	2.00	78.53	1.83
43	Swamp	Ohio	†Rep. U. S. Dep't Ag., 1878, p. 147	7.63	1.84	11.59	1.54	74.99	2.41	2.00	12.55	1.67	81.17	2.61
44	Sonora Club	Oregon	Rep. Mich. B'd of Ag., 1877, p. 351	10.91	1.46	10.63	......	*a*77.00	......	1.63	11.93	......	*a*86.44	......
45	Clawson	...do	*Ibid.*, p. 351	12.99	1.77	10.50	......	*a*74.74	......	2.03	12.07	......	*a*85.90	......
46	Foizy	...do	†Rep. U. S. Dep't Ag., 1878, p. 147	8.98	1.57	8.40	1.25	77.52	2.28	1.73	9.23	1.37	85.16	2.51
47	Brazilian	...do	†*Ibid.*, p. 147	9.29	1.77	9.45	1.17	76.33	1.99	1.95	10.42	1.29	84.15	2.19
48	White	...do	†*Ibid.*, p. 147	9.52	1.57	8.58	1.53	77.11	1.69	1.74	9.47	1.68	85.24	1.87
49	Fultz	Wisconsin	U. S. Census	12.34	1.89	11.09	1.76	71.30	1.62	2.15	12.65	2.01	81.34	1.85
50	Victor	Canada	†Rep. U. S. Dep't Ag., 1878, p. 147	7.49	1.30	9.45	1.69	77.71	2.27	1.50	10.22	1.83	84.01	2.44

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

WINTER WHEAT, KERNEL—Continued.

No.	Variety.	State.	Reference.	Analysis. Water.	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
51	Silver Chaff	Canada	†*Ibid.*, p. 147	8.93	1.58	9.89	1.75	75.41	2.44	1.73	10.86	1.92	82.81	2.68
52	Soules, from British Columbia.		Rep. Mich. B'd Ag., 1877, p. 350	8.51	1.63	12.25	......	*a*77.61	......	1.78	13.39	......	*a*84.84	......
53	Soules, from British Columbia.		*Ibid.*, p. 350	11.22	2.09	11.88	......	*a*74.81	......	2.35	13.34	......	*a*84.29	......
54	Soules, from British Columbia.		*Ibid.*, p. 350	10.07	1.89	13.45	......	*a*74.59	......	2.10	14.96	......	*a*82.94	......
55	Buckeye, or White Wabash.		*Ibid.*, p. 350	12.73	1.38	10.97	......	*a*74.92	......	1.58	12.69	......	*a*85.73	......
56	Fultz		†Rep. U. S. Dep't Ag., 1879, p. 100	10.40	1.15	11.90	1.71	72.39	2.45	1.28	13.27	1.90	80.80	2.75
57	"No. 2" Red Winter		U. S. Census	12.84	1.86	10.94	1.79	71.04	1.53	2.13	12.56	2.05	81.50	1.76
	Average (57 analyses)			11.18	1.70	11.70	*b*1.66	*b*71.81	*b*1.95	1.92	13.18	1.87	80.83	2.20
	Maximum			13.77	2.09	14.47	1.93	77.71	2.67	......	......	......	......	......
	Minimum			7.49	1.15	8.40	1.17	68.08	1.26	......	......	......	......	......

a The fiber, carbhydrates, and fat not separated. *b* Average of 18 analyses.

WINTER WHEAT, CALIFORNIA, KERNEL.

No.	Variety.	State.	Reference.	Analysis. Water.	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
58	Macaroni (crop of 1879)	California	U. S. Census	10.70	1.97	13.76	1.90	70.21	1.46	2.21	15.40	2.13	78.62	1.64
59	Macaroni (crop of 1879)	...do	*Ibid*	10.93	1.45	12.84	1.75	71.40	1.63	1.63	14.41	1.97	80.16	1.83
60	White Club (crop of 1879).	...do	*Ibid*	11.23	1.93	8.25	2.14	74.78	1.67	2.17	9.29	2.40	84.26	1.88
61	"No. 1," S. F. Produce Exch. (crop of 1879).	...do	*Ibid*	11.03	1.78	9.69	2.15	73.58	1.77	2.00	10.89	2.42	82.70	1.99
	Average (4 analyses)			10.97	1.78	11.14	1.98	72.50	1.63	2.00	12.52	2.22	81.44	1.82
	Maximum			11.23	1.97	13.76	2.15	74.78	1.77	......	......	......	......	......
	Minimum			10.70	1.45	8.25	1.75	70.21	1.46	......	......	......	......	......

SPRING WHEAT, KERNEL.

No.	Variety.	State.	Reference.	Analysis. Water.	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
62	Scotch Fife	Dakota	U. S. Census	12.60	1.98	13.50	2.01	68.09	1.82	2.26	15.45	2.29	77.92	2.08
63	Scotch Fife	...do	*Ibid*	12.90	1.77	13.25	1.93	68.33	1.82	2.03	15.21	2.22	78.46	2.08
64	Amber Bearded	Maine	*Ibid*	13.35	1.79	11.81	1.99	69.06	2.00	2.06	13.62	2.29	79.72	2.31
65	"Spring wheat"	Minnesota	Rep. Mich. B'd Ag., 1877, p. 350	11.13	1.95	14.00	......	*a*72.92	......	2.20	15.75	......	*a*82.05	......
66	Champlain	New York	†Rep. U. S. Dep't Ag., 1878, p. 48	8.79	2.05	15.40	1.49	69.72	2.55	2.25	16.89	1.63	76.43	2.80
67	Defiance	...do	†*Ibid.*, p. 48	8.12	1.57	14.00	2.04	71.78	2.49	1.71	15.23	2.22	78.13	2.71
68	Chili Club	Oregon	†*Ibid.*, p. 48	7.90	1.56	8.14	1.41	78.68	2.33	1.69	8.83	1.53	85.42	2.53
69	Noah Island	...do	†*Ibid*	9.64	2.00	9.80	1.92	74.58	2.06	2.21	10.84	2.12	82.55	2.28
70	Red Mammoth	Wisconsin	U. S. Census	12.13	2.30	15.13	2.30	66.07	2.07	2.60	17.22	2.60	75.23	2.35
71	Improved Fife, from Canada.		†Rep. U. S. Dep't. Ag., 1878, p. 48	8.50	1.47	14.70	1.62	71.15	2.56	1.61	16.07	1.77	77.75	2.80
	Average (10 analyses)			10.50	1.84	12.07	*b*1.86	*b*70.64	*b*2.19	2.05	14.50	2.07	78.92	2.46
	Maximum			13.35	2.30	15.40	2.30	78.68	2.56	......	......	......	......	......
	Minimum			7.90	1.47	8.14	1.41	66.07	1.82	......	......	......	......	......
	Average of all wheats (71 analyses).			11.07	1.73	11.84	1.70	71.68	1.98	1.94	13.31	1.91	80.61	2.23
	Maximum			13.77	2.30	15.00	2.30	77.71	2.67	......	......	......	......	......
	Minimum			7.49	1.15	8.14	1.17	66.07	1.26	......	......	......	......	......

a The fiber, carbhydrates, and fat not separated. *b* Average of 9 analyses.

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

WHEAT FLOUR.

No.	Variety.	State.	Reference.	Analysis. Water.	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
72	Tea wheat	Kansas	Rep. Mich. B'd Ag., 1877, p. 350	12.43	0.59	13.56	......	a73.42	......	0.67	15.48	......	a83.85	......
73	Grass wheat	...do	*Ibid.*, p. 350	11.92	0.59	13.31	......	a74.18	......	0.67	15.06	......	a84.27	......
74	Early May	...do	*Ibid.*, p. 350	10.70	0.57	11.37	......	a77.36	......	0.64	12.73	......	a80.63	......
75	Blue Stem	...do	*Ibid.*, p. 350	10.99	0.57	11.37	......	a77.07	......	0.64	12.76	......	a86.60	......
76	Mammoth Spring	...do	*Ibid.*, p. 350	10.96	0.69	13.31	......	a75.04	......	0.78	14.96	......	a84.26	......
77	Clawson	Michigan	*Ibid.*, p. 350	9.93	0.63	11.25	......	a78.19	......	0.70	12.49	......	a86.81	......
78	Clawson	...do	*Ibid.*, p. 350	10.69	0.64	9.62	......	a79.05	......	0.72	10.78	......	a88.50	......
79	Weeks	...do	*Ibid.*, p. 350	9.10	0.65	10.50	......	a79.75	......	0.72	11.55	......	a87.73	......
80	Powers	...do	*Ibid.*, p. 350	10.15	0.48	11.59	......	a77.78	......	0.53	12.91	......	a86.56	......
81	Armstrong	...do	*Ibid.*, p. 350	12.61	0.63	12.25	......	a74.51	......	0.72	14.02	......	a85.26	......
82	Tuscan	...do	*Ibid.*, p. 350	13.43	0.72	10.94	......	a74.91	......	0.83	12.63	......	a86.54	......
83	Diehl	...do	*Ibid.*, p. 350	8.28	0.62	10.94	......	a80.16	......	0.68	11.93	......	a87.30	......
84	Diehl	...do	*Ibid.*, p. 350	9.29	0.65	9.71	......	a80.35	......	0.72	10.71	......	a88.57	......
85	Soules	...do	*Ibid.*, p. 350	10.65	0.62	10.00	......	a78.73	......	0.69	11.19	......	a88.02	......
86	Fultz	...do	*Ibid.*, p. 350	9.69	0.66	8.94	......	a80.71	......	0.73	9.90	......	a89.37	......
87	Treadwell	...do	*Ibid.*, p. 350	10.46	0.66	10.63	......	a78.25	......	0.73	11.87	......	a87.40	......
88	Buckeye	...do	*Ibid.*, p. 350	10.66	0.63	9.69	......	a79.02	......	0.71	10.86	......	a88.43	......
89	Asiatic	...do	*Ibid.*, p. 350	9.66	0.64	11.00	......	a78.70	......	0.71	12.18	......	a87.11	......
90	Gold Medal	...do	*Ibid.*, p. 350	9.56	0.67	9.80	......	a79.97	......	0.74	10.84	......	a88.42	......
91	Gold Medal	...do	*Ibid.*, p. 350	9.66	0.64	11.01	......	a78.69	......	0.71	12.19	......	a87.10	......
92	Egyptian Red	...do	*Ibid.*, p. 350	9.71	0.66	10.75	......	a78.88	......	0.73	11.90	......	a87.37	......
93	Washburn's Superlative.	Minnesota	U. S. Census	13.17	0.43	12.13	0.08	73.15	1.04	0.49	13.97	0.09	84.26	1.19
94	Christian's	...do	*Ibid*	12.52	0.40	12.16	0.07	73.80	1.05	0.46	13.90	0.08	84.36	1.20
95	Queen Bee	New York	*Ibid*	12.14	0.56	11.63	0.09	74.32	1.26	0.64	13.25	0.10	84.58	1.43
96	Washburn's	Minnesota	*Ibid*	13.10	0.35	11.75	0.06	73.70	1.04	0.40	13.53	0.07	84.81	1.19
97	Straight	...do	*Ibid*	12.16	0.58	13.31	0.15	72.63	1.17	0.66	15.15	0.17	82.69	1.33
98	Straight	New York	*Ibid*	13.02	0.59	9.87	0.16	75.17	1.19	0.68	11.35	0.18	86.42	1.37
99	Patent	Missouri	*Ibid*	11.10	0.52	10.00	0.13	76.93	1.23	0.58	11.26	0.14	86.64	1.38
100	W. W. W. W. entire wheat.	New York	*Ibid*	13.09	1.45	13.07	0.99	69.52	1.88	1.66	15.04	1.14	80.00	2.16
101	Baking Flour	Wisconsin	*Ibid*	12.74	0.48	11.88	0.09	73.67	1.14	0.55	13.63	0.10	84.41	1.31
102	Perfection	Missouri	*Ibid*	11.26	0.38	11.06	0.09	76.13	1.08	0.42	12.46	0.10	85.82	1.20
103	White Silk	...do	*Ibid*	12.05	0.45	9.69	0.11	76.61	1.09	0.51	11.03	0.13	87.09	1.24
104	Snowflake	Michigan	*Ibid*	12.96	0.53	8.56	0.17	76.59	1.19	0.61	9.83	0.19	88.01	1.36
105	Hill's XXXX	New York	*Ibid*	13.04	0.50	10.54	0.14	74.62	1.16	0.57	12.13	0.16	85.80	1.34
106	Bluejacket	...do	*Ibid*	12.60	0.52	10.45	0.14	75.09	1.20	0.59	11.96	0.16	85.92	1.37
107	New Hampton	New Jersey	*Ibid*	12.80	0.69	11.56	0.22	73.43	1.30	0.79	13.25	0.25	84.22	1.49
108	Washburn's Superlative.	Minnesota	*Ibid*	12.67	0.34	12.50	0.07	73.48	0.94	0.39	14.31	0.08	84.15	1.07
109	Palisade	...do	*Ibid*	12.46	0.52	11.81	0.15	73.91	1.15	0.59	13.49	0.17	84.44	1.31
110	Early Riser	Illinois	*Ibid*	12.02	0.41	10.44	0.08	76.24	0.81	0.47	11.87	0.09	86.66	0.91
111	Bain's Choice	Missouri	*Ibid*	12.22	0.41	9.69	0.10	76.65	0.93	0.47	11.04	0.11	87.32	1.06
112	Minnesota	Minnesota	Rep. Mich. B'd Ag., 1877, p. 350	11.78	0.49	12.25	......	a75.49	......	0.56	13.88	......	a85.56	......
113	Minnesota	...do	*Ibid.*, p. 350	12.80	0.55	12.50	......	a74.15	......	0.63	14.33	......	a85.04	......
114	"Patent Process"	Michigan	*Ibid.*, p. 350	10.31	0.60	10.94	......	a78.15	......	0.67	12.19	......	a87.14	......
115	"New Process"		Rep. Midd. Ag'l Exp. St., 1877–'78, p. 25.	13.50	0.42	10.92	......	b74.04	1.12	0.49	12.63	......	b85.58	1.30
116	No. 1 flour		*Ibid.*, p. 25	11.98	0.46	8.71	......	b78.11	0.74	0.52	9.88	......	b88.76	0.84
117	No. 2 flour		*Ibid.*, p. 25	12.46	0.50	8.56	......	b77.92	0.56	0.57	9.75	......	b89.04	0.64
118	No. 3 flour		*Ibid.*, p. 25	10.30	0.55	9.59	......	b78.52	1.04	0.61	10.69	......	b87.54	1.16
119	New Process		Rep. Ct. Ag'l Exp. St., 1880, p. 85	12.79	0.50	12.31	0.07	73.14	1.19	0.57	14.12	0.08	83.84	1.39
120	Wheat flour, from entire wheat.		*Ibid.*, p. 85	12.89	1.44	14.12	1.22	68.32	2.01	1.65	16.20	1.40	78.45	2.30
	Average (49 analyses)			11.56	0.59	11.09	c0.17	c75.43	c1.14	0.66	12.53	0.19	85.34	1.28
	Maximum			13.50	1.45	13.56	1.22	78.52	2.01	......	......	......	......	......
	Minimum			8.28	0.34	8.56	0.06	68.32	0.56	......	......	......	......	......

a The fiber, carbhydrates, and fat not separated. b Fiber not separated. c Average of 25 analyses.

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

GRAHAM FLOUR.

No.	Variety.	State.	Reference.	Analysis. Water.	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
121	Rochester	New York	U. S. Census	12.06	1.97	12.44	1.83	69.80	1.90	2.24	14.15	2.08	79.37	2.16
122	Honeoye	...do	*Ibid*	13.52	1.68	11.31	1.99	70.00	1.50	1.94	13.08	2.30	80.95	1.73
123	Kelly's No. 1 Graham flour.	...do	*Ibid*	13.69	1.67	11.25	1.78	69.89	1.72	1.93	13.04	2.06	80.98	1.99
	Average (3 analyses)			13.00	1.77	11.67	1.87	69.89	1.71	2.04	13.42	2.15	80.43	1.96
	Maximum			13.69	1.97	12.44	1.99	70.00	1.90					
	Minimum			12.06	1.67	11.25	1.78	69.80	1.50					

WHEAT BRAN, MIDDLINGS, AND SHORTS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
124	Wheat bran		U. S. Census	12.21	4.15	7.81	16.64	56.19	3.00	4.73	8.89	18.95	64.01	3.42
125	Western wheat bran		Rep. Ct. Ag'l Exp. St., 1877, p. 50	12.12	6.33	13.50	8.79	55.90	3.36	7.21	15.36	10.11	63.48	3.84
126	"Fine Feed"—ground bran.		*Ibid* p. 50	10.47	5.56	13.88	7.98	58.88	3.23	6.22	15.51	8.92	65.73	3.62
127	Bran	Michigan	Rep. Mich. B'd Ag., 1878, p. 410	11.65	5.63	14.00	9.13	55.56	4.03	6.37	15.83	10.31	62.93	4.56
128	Western wheat bran		Rep. N. J. Ag'l Exp. St., 1880, p. 47	10.88	5.90	16.06	7.99	55.12	4.05	6.62	18.02	8.98	61.84	4.54
129	Wheat middlings		Rept. Ct. Ag'l Exp. St., 1877, p. 50	10.56	3.45	14.22	5.35	62.90	3.52	3.86	15.91	5.97	70.32	3.94
130	Wheat middlings		Rep. Mich. B'd Ag., 1878, p. 410	11.27	2.11	13.75	3.47	65.71	3.69	2.38	15.49	3.91	74.06	4.16
131	Illinois middlings		Bull. Bussey Inst., 1874, p. 27	13.30	2.71	10.13	5.35	64.80	3.71	3.12	11.68	6.17	74.75	4.28
132	St. Louis middlings		*Ibid.*, p. 27	12.08	1.57	11.06	3.57	69.21	2.51	1.79	12.58	4.06	78.72	2.85
133	No. 1 middlings		Rep. Midd. Ag'l Exp. St., 1877-'78, p. 26.	11.32	1.39	10.48	3.88	70.86	2.07	1.57	11.82	4.38	79.90	2.33
134	No. 2 middlings		*Ibid.*, p. 26	12.27	4.06	13.33	7.45	61.21	2.68	4.63	15.19	8.50	68.63	3.05
135	Shorts		Rep. Mich. B'd Ag., 1878, p. 410	11.26	3.95	15.13	7.46	57.35	4.85	4.46	17.07	8.41	64.59	5.47
136	Michigan shorts		Bull. Bussey Inst., 1874, p. 27	11.77	4.06	12.75	10.47	56.30	4.65	4.59	14.46	11.87	63.80	5.28
137	Illinois shorts		*Ibid.*, p. 27	10.96	4.24	11.13	7.29	62.32	4.06	4.76	12.51	8.20	69.96	4.57
138	St. Louis shorts		*Ibid.*, p. 27	12.23	4.53	12.06	7.12	60.05	4.01	5.17	13.73	8.11	68.44	4.55
139	Wheat shorts		Rep. Midd. Ag'l Exp. St., 1877-'78, p. 26.	11.31	3.94	13.91	6.34	62.10	2.50	4.44	15.68	7.04	70.02	2.82
140	Coarse wheat feed (white wheat).		Rep. Ct. Ag'l Exp. St., 1877, p. 50	10.87	5.75	13.63	7.56	58.92	3.27	6.40	15.30	8.47	66.13	3.64
141	Coarse wheat feed (red wheat).		*Ibid.*, p. 59	11.14	5.99	12.13	9.31	58.36	3.07	6.73	13.65	10.47	65.65	3.50
142	Mill feed		Rep. Mich. B'd Ag., 1878, p. 410	11.29	2.24	11.38	5.22	65.52	4.35	2.50	12.83	5.88	73.89	4.90
143	St. Louis ship-stuff		Bull. Bussey Inst., 1874, p. 27	11.81	2.25	11.12	5.50	66.46	2.77	2.55	12.67	6.34	75.32	3.14
144	Purified middlings (*a*)		Rep. Midd. Ag'l Exp. St., 1877-'78, p. 26.	12.35	0.50	10.40	......	75.50	1.24	0.57	11.87	......	86.14	1.42
	Average (20 analyses)			11.53	3.94	12.57	7.29	61.20	3.47	4.45	14.20	8.24	69.15	3.96
	Maximum			13.30	6.33	16.06	16.64	70.86	4.85					
	Minimum			10.47	1.39	7.81	3.47	55.12	2.07					

a This has more nearly the composition of flour, and is not included in the *average*. Fiber not determined.

MAIZE KERNEL, FLINT VARIETIES.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
145	White pop-corn, crop of 1876.	Connecticut	U. S. Census	11.84	1.24	9.69	1.22	71.09	4.92	1.41	11.00	1.39	80.61	5.59
146	No. 145, popped, crop of 1876.	...do	*Ibid*	4.88	1.35	10.25	1.26	77.34	5.42	1.41	10.72	1.32	80.88	5.67
147	Vermont White Cap, crop of 1877.	...do	Rep. Ct. Ag'l Exp. St., 1877, p. 57	10.86	1.53	11.06	1.04	71.22	4.29	1.72	12.41	1.17	79.89	4.81
148	Rowley, crop of 1877	...do	*Ibid.*, p. 57	11.00	1.61	11.63	0.78	70.15	4.83	1.81	13.06	0.88	78.83	5.42
149	Yellow or Canada	...do	Rep. Middletown Ag'l Exp. St., 1877-'78, p. 29.	15.10	1.36	10.01	1.24	66.99	5.31	1.60	11.56	1.69	78.90	6.25
150	Old-fashioned Yellow, crop of 1878.	...do	Rep. Ct. Ag'l Exp. St., 1879, p. 88	10.58	1.43	9.81	1.39	72.11	4.68	1.60	10.99	1.55	80.63	5.23
151	King Philip	...do	Rep. Ct. Ag'l Exp. St., 1880, p. 81	15.97	1.35	10.31	1.37	66.50	4.50	1.60	12.27	1.62	79.15	5.36
152	Common Yellow	...do	*Ibid.*, p. 81	15.77	1.26	10.00	1.47	67.06	4.44	1.49	11.88	1.74	79.62	5.27
153	White Flint	...do	*Ibid.*, p. 81	16.82	1.19	8.94	1.32	67.84	3.89	1.43	10.74	1.58	81.57	4.68
154	Waushakum	Massachusetts	U. S. Census	13.05	1.29	10.69	1.11	69.80	4.06	1.48	12.31	1.28	80.26	4.67

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

MAIZE KERNEL, FLINT VARIETIES—Continued.

No.	Variety.	State.	Reference.	Analysis.						Calculated water free.				
				Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
155	No. 154, roasted	Massachusetts	*Ibid*	4.53	1.41	11.06	1.35	76.74	4.91	1.48	11.58	1.41	80.39	5.14
156	Wheeler's Prolific	do	Agriculture of Mass., 1879, p. 238	12.69	1.39	12.06	1.82	67.46	4.58	1.60	13.80	2.08	77.28	5.24
157	Clark	do	*Ibid.*, p. 239	12.12	1.64	12.12	2.46	66.91	4.75	1.86	13.79	2.79	76.16	5.40
158	Tip	do	*Ibid.*, p. 239	8.86	1.57	12.85	2.53	68.93	5.26	1.72	14.10	2.78	75.62	5.78
159	Canada	do	*Ibid.*, p. 241	13.44	1.27	12.02	2.40	66.31	4.56	1.46	13.90	2.77	76.61	5.26
160	Canada Dutton	do	*Ibid.*, p. 242	14.36	1.42	10.33	2.38	66.51	5.00	1.66	12.07	2.76	77.67	5.84
161	Massachusetts Red	do	Unpublished; communicated by Dr. S. P. Sharples.	11.95	1.10	12.06	2.02	69.47	3.40	1.25	13.69	2.29	78.91	3.86
162	Massachusetts White	do	*Ibid*	10.22	1.44	9.22	1.47	74.24	3.40	1.60	10.26	1.67	82.67	3.79
163	Smut-nose	Michigan	‡Rep. Mich. B'd of Agriculture, 1878, p. 409.	12.90	1.54	11.81	2.00	66.81	4.94	1.76	13.55	2.29	76.63	5.67
164	Smut-nose	do	‡ *Ibid.*, p. 409	13.26	1.49	11.51	2.49	66.11	5.14	1.72	13.27	2.87	76.21	5.93
165	Eight-rowed Flint	do	‡ *Ibid.*, p. 409	13.45	1.43	12.00	2.26	66.03	4.83	1.65	13.86	2.61	76.30	5.58
166	Sanford	do	‡ *Ibid.*, p. 409	13.37	1.37	10.69	2.10	67.41	5.06	1.58	12.34	2.42	77.82	5.84
167	Adams	New Hampshire	†Rep. U. S. Dep't Ag., 1878, p. 149	8.61	1.57	10.50	1.19	73.30	4.83	1.72	11.48	1.30	80.22	5.28
168	Canada	do	† *Ibid.*, p. 149	8.27	1.72	11.36	1.26	71.79	5.60	1.87	12.36	1.37	78.29	6.11
169	Small Twelve-rowed	do	† *Ibid.*, p. 149	11.48	1.34	10.50	1.09	69.56	6.03	1.51	11.87	1.23	78.58	6.81
170	Small Eight-rowed	do	† *Ibid.*, p. 148	11.05	1.57	13.65	1.30	67.63	4.80	1.76	15.35	1.46	76.03	5.40
171	State Fair Premium	do	† *Ibid.*, p. 149	10.19	1.78	10.82	1.06	70.86	5.29	1.98	12.05	1.18	78.90	5.89
172	Large Premium	do	† *Ibid.*, p. 149	10.00	1.46	11.36	1.09	70.57	5.52	1.62	12.63	1.21	78.40	6.14
173	Board of Agriculture	do	† *Ibid.*, p. 149	11.09	1.31	11.55	0.82	70.55	4.68	1.47	12.99	0.90	79.38	5.26
174	King Philip	do	† *Ibid.*, p. 149	10.23	1.84	12.08	1.01	67.79	7.05	2.04	13.47	1.13	75.50	7.86
175	Miscegenation	do	*Ibid.*, p. 148	9.92	1.63	11.72	1.05	70.35	5.33	1.81	13.01	1.17	78.09	5.92
176	Pitch Knot	do	† *Ibid.*, p. 148	11.24	1.52	11.20	1.04	69.74	5.26	1.71	12.62	1.17	78.58	5.92
177	Tom Thumb	do	† *Ibid.*, p. 148	9.05	1.60	12.60	1.33	69.53	5.89	1.76	13.85	1.46	76.46	6.47
178	White and Yellow pop-corn, crop of 1879.	New York	U. S. Census	12.55	1.28	10.34	1.16	70.49	4.18	1.46	11.83	1.32	80.60	4.79
179	No. 178, popped	do	*Ibid*	4.10	1.40	11.06	1.44	77.26	4.74	1.46	11.53	1.50	80.56	4.94
180	Norfolk White	North Carolina	Rep. Ct. Ag'l Exp. St., 1877, p. 57	11.17	1.31	10.88	1.90	70.04	4.70	1.48	12.25	2.14	78.84	5.29
181	Oregon White	Oregon	†Rep. U. S. Dep't Ag., 1878, p. 148	9.25	1.46	7.88	1.26	73.07	7.08	1.61	8.68	1.39	89.52	7.80
182	Compton's Early	Pennsylvania	† *Ibid.*, p. 149	6.59	1.64	9.90	2.09	74.48	5.30	1.76	10.59	2.24	79.74	5.67
183	Southern White	South Carolina	Mass. Agriculture, 1879, p. 240	9.86	1.37	12.47	2.03	69.78	4.48	1.50	13.85	2.22	77.46	4.97
184	Improved Prolific	Tennessee	†Rep. U. S. Dep't Ag., 1878, p. 148	7.58	1.23	9.29	2.65	74.16	5.09	1.33	10.05	2.87	80.24	5.51
185	Vermont	Vermont	† *Ibid.*, p. 149	8.64	1.45	10.14	1.38	72.76	5.63	1.59	11.10	1.51	79.63	6.17
186	Western Yellow		Rep. Middletown Ag'l Exp. St., 1877–'78, p. 29.	13.93	1.25	8.82	1.59	70.48	3.92	1.45	10.25	1.85	81.89	4.56
187	Southern White		*Ibid.*, p. 29	13.82	1.32	8.80	0.88	71.07	4.02	1.53	10.31	1.02	82.47	4.67
188	Early Dutton		‡ Am. Jour. Sci. and Arts, 1869, p. 352	8.08	1.52	9.62	2.52	72.62	5.64	1.66	10.46	2.74	78.98	6.16
189	Common Yellow, or Canada.		‡ *Ibid.*, p. 352	10.52	1.31	9.72	2.40	71.63	4.42	1.46	10.86	2.68	80.06	4.94
190	King Philip, or Rhode Island.		‡ *Ibid.*, p. 352	9.70	1.60	11.87	2.21	70.08	4.45	1.77	13.16	2.45	77.69	4.93
191	White Mexican		†Rep. U. S. Dep't Ag. 1878, p. 148	8.65	1.87	10.15	1.64	72.79	4.90	2.04	11.11	1.79	79.70	5.36
192	Pop-corn (white)		† *Ibid.*, p. 149	8.61	1.63	13.13	2.32	68.68	5.63	1.78	14.37	2.54	75.15	6.16
	Average (48 analyses)			10.85	1.45	10.87	1.61	70.29	4.93	1.68	12.19	1.79	78.84	5.50
	Maximum			16.82	1.87	13.65	2.65	77.34	7.05					
	Minimum			4.10	1.10	7.88	0.78	66.03	3.40					

MAIZE KERNEL, DENT VARIETIES.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
193	Yellow Dent, crop of 1879.	California	U. S. Census	11.42	1.37	11.31	1.56	69.16	5.18	1.55	12.76	1.76	78.08	5.85
194	Ohio Dent, crop of 1877	Connecticut	Rep. Ct. Ag'l Exp. St., 1877, p. 57	10.78	1.37	10.06	1.35	71.30	5.14	1.54	11.27	1.51	79.92	5.76
195	Coe's Prolific, crop of 1878.	do	Rep. Ct. Ag'l Exp. St., 1879, p. 88	9.55	1.45	10.13	2.19	72.70	3.98	1.60	11.21	2.42	80.36	4.41
196	Benton, crop of 1878	do	*Ibid.*, p. 88	10.70	1.57	9.97	1.36	71.40	5.00	1.76	11.18	1.52	79.94	5.60
197	Scioto, crop of 1878	do	*Ibid.*, p. 88	10.43	1.53	9.25	1.80	72.98	4.01	1.71	10.31	2.01	81.49	4.48

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

MAIZE KERNEL, DENT VARIETIES—Continued.

No.	Variety.	State.	Reference.	Analysis.						Calculated water free.				
				Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
198	Early Scioto	Connecticut	Rep. Ct. Ag'l Exp. St., 1880, p. 81	15.24	1.28	8.31	1.59	69.78	3.80	1.50	9.81	1.88	82.33	4.48
199	White Ohio, crop of 1878.	...do	Rep. Ct. Ag'l Exp. St., 1879, p. 88	9.70	1.70	11.28	1.73	71.39	4.20	1.88	12.50	1.92	78.95	4.65
200	Wisconsin, crop of 1878	...do	*Ibid.*, p. 88	9.72	1.56	11.60	2.06	70.17	4.89	1.73	12.85	2.28	77.72	5.42
201	White Prolific, crop of 1878.	...do	*Ibid.*, p. 88	10.14	1.67	9.19	1.34	73.38	4.28	1.86	10.23	1.49	81.66	4.76
202	Extra early Adams, crop of 1878.	...do	*Ibid.*, p. 88	10.94	1.75	10.81	1.48	70.21	4.81	1.97	12.14	1.66	78.83	5.40
203	Western White	Illinois	Mass. Agriculture, 1879, p. 244	10.77	1.35	11.40	2.47	69.72	4.29	1.51	12.85	2.80	78.10	4.74
204	Western Yellow	...do	*Ibid.*, p. 244	11.90	1.41	10.80	2.95	68.39	4.46	1.60	12.37	3.34	77.64	5.05
205	White Oil	Indiana	‡Rep. Mich. B'd Ag., 1878, p. 409	11.20	1.28	10.50	1.90	70.16	4.87	1.44	11.83	2.14	79.10	5.49
206	Early Southern	Massachusetts	Agriculture of Mass., 1879, p. 243	12.97	1.64	11.54	2.41	66.62	4.83	1.87	13.26	2.77	76.56	5.54
207	Yellow Dent, crop of 1877.	Michigan	‡Rep. Mich. B'd Ag., 1878, p. 408	12.74	1.41	11.75	2.49	66.98	4.63	1.62	13.47	2.85	76.75	5.31
208	Yellow Dent, crop of 1877.	...do	‡*Ibid.*, p. 408	11.66	1.51	11.48	2.48	67.80	5.07	1.71	12.99	2.81	76.75	5.74
209	White Dent, crop of 1877.	...do	‡*Ibid.*, p. 408	13.73	1.60	11.52	2.26	66.26	4.63	1.85	13.35	2.62	76.81	5.37
210	Hackberry Dent, crop of 1877.	...do	‡*Ibid.*, p. 408	12.47	1.47	9.88	2.30	69.11	4.77	1.68	11.29	2.74	78.84	5.45
211	Strawberry Roan, crop of 1877.	...do	‡*Ibid.*, p. 409	14.05	1.39	10.31	2.03	67.63	4.59	1.62	12.00	2.36	78.68	5.34
212	Pony Dent, crop of 1877	...do	‡*Ibid.*, p. 409	13.42	1.40	11.25	2.16	66.94	4.83	1.62	12.99	2.49	77.32	5.58
213	Pony Dent	...do	‡*Ibid.*, p. 409	13.20	1.31	10.63	2.21	67.53	5.03	1.51	12.26	2.55	77.88	5.80
214	Yellow Dent	Minnesota	U. S. Census	12.14	1.63	9.50	1.62	70.86	4.25	1.86	10.82	1.85	80.63	4.84
215	No. 214, roasted	...do	*Ibid*	6.22	1.74	10.44	1.72	75.26	4.62	1.86	11.13	1.83	80.25	4.93
216	White Dent	North Carolina	†Rep. U. S. Dep't Ag., 1878, p. 148	6.74	1.43	11.03	1.53	74.09	5.18	1.53	11.82	1.63	79.47	5.55
217	White Prolific	Pennsylvania	†*Ibid.*, p. 148	8.96	1.43	8.05	1.25	74.49	5.82	1.57	8.84	1.37	81.82	6.40
218	Mexican White		†*Ibid.*, p. 148	11.14	1.45	10.67	1.59	68.87	6.28	1.64	11.99	1.79	77.51	7.07
	Average (26 analyses).			11.23	1.48	10.49	1.91	70.15	4.74	1.66	11.81	2.14	79.06	5.33
	Maximum			15.24	1.79	11.75	2.95	75.26	6.28					
	Minimum			6.22	1.28	8.05	1.25	66.26	3.80					

MAIZE KERNEL, SWEET VARIETIES.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
219	Sweet (immature Aug. 9), crop of 1877.	Connecticut	Rep. Ct. Ag'l Exp. St., 1878, p. 67	10.12	2.19	14.50	2.57	62.70	7.92	2.44	16.14	2.86	69.75	8.81
220	Sweet (boiling corn), Aug. 25, crop of 1877.	...do	*Ibid.*, p. 67	10.09	2.08	15.31	2.52	61.78	8.22	2.31	17.02	2.80	68.73	9.14
221	Sweet, full grown, Sept. 25, crop of 1877.	...do	*Ibid.*, p. 67	9.45	2.06	14.38	1.93	63.05	9.13	2.27	15.88	2.13	69.64	10.08
222	Stowell's Evergreen	...do	Am. Jour. Sci. and Arts, 1860, p. 352.	10.86	1.89	11.10	2.63	65.86	7.66	2.12	12.45	2.95	73.89	8.59
223	Mammoth Sweet, crop of 1878.	...do	Rep. Ct. Ag'l Exp. St., 1879, p. 88	9.43	1.93	12.32	2.75	66.09	7.48	2.13	13.60	3.04	72.97	8.26
224	Egyptian	Maryland	†Rep. U. S. Dep't Ag., 1878, p. 148	7.54	1.92	11.55	2.02	69.17	7.80	2.07	12.58	2.19	74.73	8.53
225	Golden Sugar	Massachusetts	†*Ibid.*, p. 148	6.27	1.93	14.35	1.58	66.70	9.17	2.06	15.31	1.69	71.16	9.78
226	Marblehead Mammoth.	...do	†*Ibid.*, p. 148	6.47	1.92	12.78	1.88	67.95	9.00	2.06	13.67	2.01	72.64	9.62
227	Proctor	...do	†*Ibid.*, p. 148	10.13	1.92	12.08	1.75	66.17	7.95	2.14	13.44	1.95	73.63	8.84
228	Blue Texas	...do	Agriculture of Mass., 1879, p. 240	7.74	1.60	13.86	2.56	65.54	8.70	1.73	15.02	2.77	71.05	9.43
229	Crosby	...do	*Ibid.*, p. 245	10.50	1.77	11.60	2.47	66.75	6.91	1.97	12.96	2.76	74.60	7.71
230	Red River	Minnesota	†Rep. U. S. Dep't Ag., 1878, p. 148	9.13	1.89	11.73	1.46	66.48	9.31	2.07	12.92	1.60	73.17	10.24
231	Stowell's Evergreen		†*Ibid.*, p. 148	5.98	1.92	11.91	2.66	69.53	8.00	2.04	12.67	2.83	73.95	8.51
232	Prolific		†*Ibid.*, p. 148	10.38	1.87	10.33	2.04	67.73	7.65	2.07	11.49	2.26	75.68	8.50
233	Mexican Blue		†*Ibid.*, p. 148	8.97	1.42	10.21	1.80	72.35	5.25	1.56	11.22	1.98	79.47	5.77
234	Burr's Sweet		Not published; communicated by Dr. S. P. Sharples.	10.68	2.22	11.69	4.94	62.70	7.77	2.48	13.08	5.53	70.21	8.70
	Average (14 analyses) (*a*).			8.81	1.87	12.15	2.31	66.87	7.99	2.04	13.32	2.53	73.34	8.77
	Maximum			10.86	2.22	15.31	4.94	72.35	9.31					
	Minimum			5.98	1.42	10.21	1.46	61.78	5.25					

a The immature sweet corn (Nos. 219 and 220) are not included.

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

MAIZE KERNEL, UNCLASSIFIED VARIETIES.

No.	Variety.	State.	Reference.	Analysis. Water	Analysis. Ash.	Analysis. Albuminoids (protein).	Analysis. Fiber.	Analysis. Carbhydrates (starch, gum, etc.).	Analysis. Fat.	Calculated water free. Ash.	Calculated water free. Albuminoids (protein).	Calculated water free. Fiber.	Calculated water free. Carbhydrates (starch, gum, etc.).	Calculated water free. Fat.
235	Tuscarora, crop of 1877	Connecticut	Rep. Ct. Ag'l Exp. St., 1877, p. 57	11.25	1.47	11.44	1.28	68.82	5.74	1.66	12.89	1.44	77.54	6.47
236		Illinois	Not published; communicated by Dr. S. P. Sharples.	13.61	1.35	9.19	3.13	69.10	3.62	1.56	10.64	3.62	79.99	4.19
237	Golden Eight-rowed	Massachusetts	*Ibid*	12.51	1.68	10.25	1.35	69.37	4.94	1.88	11.72	1.53	79.27	5.65
238	Tuscarora, crop of 1877	Michigan	‡Rep. Mich. B'd Ag., 1878, p. 409	14.08	1.52	10.86	1.80	65.97	5.77	1.77	12.64	2.09	76.78	6.72
239	White, crop of 1879	New Mexico	U. S. Census	10.92	1.58	10.06	1.75	70.10	5.59	1.77	11.28	1.97	78.71	6.27
240	Red, crop of 1879	do	*Ibid*	10.85	1.60	11.09	1.60	68.97	5.89	1.79	12.45	1.79	77.36	6.61
241	Kansas corn		Not published; communicated by Dr. S. P. Sharples.	11.34	1.07	8.81	1.28	72.90	4.60	1.20	9.92	1.43	82.26	5.19
242	Western corn		Rep. Ct. Ag'l Exp. St., 1880, p. 81	20.68	1.19	7.83	1.65	64.95	3.70	1.50	9.88	2.08	81.88	4.66
243	Western corn		*Ibid.*, p. 81	20.22	1.16	8.54	1.67	64.86	3.55	1.45	10.70	2.09	81.31	4.45
244	Western corn		*Ibid.*, p. 81	16.41	1.25	8.57	1.76	68.16	3.85	1.50	10.25	2.10	81.55	4.45
	Average (10 analyses)			14.19	1.38	9.66	1.73	68.82	4.72	1.61	11.24	2.01	79.67	5.47
	Maximum			20.68	1.60	11.44	3.13	72.90	5.89					
	Minimum			10.85	1.07	7.83	1.28	64.86	3.55					
	Average of all varieties (98 analyses).			11.00	1.51	10.82	1.80	69.58	5.29	1.70	12.16	2.02	78.16	5.96
	Maximum			20.68	2.22	15.31	4.94	77.34	9.31					
	Minimum			4.10	1.07	7.83	0.78	61.78	3.40					
	HOMINY.													
245	Hominy, southern corn, crop of 1879.		U. S. Census	13.62	0.37	8.08	0.33	77.18	0.42	0.43	9.34	0.38	89.36	0.49
246	Hominy, Indiana corn, crop of 1879.		*Ibid*	13.36	0.39	8.41	0.31	77.07	0.46	0.45	9.71	0.36	88.95	0.53
	Average (2 analyses)			13.49	0.38	8.25	0.32	77.12	0.44	0.44	9.52	0.37	89.15	0.51
	CORN MEAL.													
247			Rep. Conn. Ag'l Exp. St., 1877, p. 56.	12.91	1.17	8.69	1.79	71.93	3.51	1.34	9.97	2.06	82.60	4.03
248	Home Ground Yellow Flint.		*Ibid.*, p. 56	20.67	1.17	7.81	0.93	66.35	3.07	1.48	9.85	1.17	83.63	3.87
249	Western corn		*Ibid.*, p. 56	21.67	1.16	7.38	1.41	65.88	2.50	1.48	9.42	1.80	84.11	3.19
250	Old Western		Rep. Conn. Ag'l Exp. St., 1880, p. 81	14.56	1.22	9.12	2.16	68.89	4.05	1.43	10.68	2.52	80.64	4.73
251	New York corn		*Ibid.*, p. 81	15.32	1.47	8.63	1.83	68.77	3.98	1.72	10.19	2.18	81.21	4.70
252			Rep. N. J. Ag'l Exp. St., 1880, p. 46	13.87	1.33	7.88	1.60	71.92	3.40	1.54	9.15	1.86	83.50	3.95
253			*Ibid.*, p. 47	12.79	1.40	7.81	1.57	72.70	3.73	1.61	8.96	1.80	83.36	4.27
	Average (7 analyses)			15.97	1.27	8.19	1.61	69.50	3.46	1.50	9.76	1.92	82.72	4.10
	Maximum			21.67	1.47	9.12	2.16	72.70	4.05					
	Minimum			12.79	1.16	7.38	0.93	65.88	2.50					
	VARIOUS WASTE PRODUCTS FROM MAIZE.													
254	Hominy chops		Rep. Ct. Ag'l Exp. St., 1879, p. 93	13.53	2.44	9.50	3.19	62.02	9.32	2.82	10.88	3.70	71.83	10.77
255	Hominy chops		*Ibid.*, p. 93	11.56	2.67	9.82	4.79	62.58	8.58	3.01	11.10	5.43	70.78	9.68
256	Hominy chops		Rep. N. J. Ag'l Exp. St., 1880, p. 47.	12.56	2.64	9.63	4.02	60.95	10.20	3.02	11.02	4.59	69.71	11.66
	Average (3 analyses)			12.55	2.58	9.65	4.00	61.85	9.36	2.95	11.00	4.58	70.77	10.70
	Maximum			13.53	2.67	9.82	4.79	62.58	10.20					
	Minimum			11.56	2.44	9.50	3.19	60.95	8.58					
257	Corn feed (*a*)		Rep. Ct. Ag'l Exp. St., 1878, p. 76	62.27	0.27	5.67	1.58	28.90	1.31	0.70	15.03	4.19	76.62	3.46
258	Starch feed (*a*)		Rep. Midd. Ag'l Exp. St., 1877-'78, p. 38.	72.19	0.12	3.56	3.36	18.78	1.99	0.43	12.88	12.05	67.49	7.15
259	Residue from starch works (dried).		Rep. N. J. Ag'l Exp. St., 1880, p. 46.	8.88	1.02	15.13	8.30	58.04	8.63	1.11	16.62	9.11	63.69	9.47

a Waste product in starch manufacture.

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

MAIZE COB.

No.	Variety.	State.	Reference.	Analysis. Water.	Ash.	Albuminoids (protein.)	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Calculated water free. Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
260	From sweet corn (immature), crop of '77 (a)	Connecticut	Rep. Ct. Ag'l Exp. St., 1878, p. 72	10.10	6.70	8.56	21.40	51.14	2.10	7.45	9.52	23.80	56.89	2.34
261	From sweet corn (immature), crop of '77 (a)	...do	*Ibid.*, p. 72	9.02	2.60	3.00	29.63	54.91	0.84	2.86	3.30	32.56	60.36	0.92
262	From sweet corn, crop of 1877.	...do	*Ibid.*, p. 72	8.82	1.47	2.69	30.57	55.53	0.92	1.61	2.95	33.54	60.89	1.01
263	Ohio Dent, crop of 1877	...do	*Ibid.*, p. 72	8.21	0.97	2.56	30.99	56.99	0.28	1.06	2.79	33.75	62.10	0.30
264	Tuscarora, crop of 1877	...do	*Ibid.*, p. 72	8.37	1.57	2.56	30.01	57.15	0.34	1.71	2.79	32.75	62.38	0.37
265	Vermont White Cap, crop of 1877.	...do	*Ibid.*, p. 72	8.40	0.96	2.63	30.47	57.21	0.33	1.05	2.87	33.27	62.45	0.36
266	Rowley, crop of 1877	...do	*Ibid.*, p. 72	8.05	0.98	1.81	32.39	56.54	0.23	1.07	1.97	35.21	61.50	0.25
267	Canada Yellow	...do	*Ibid.*, p. 72	7.52	2.14	2.35	29.76	57.72	0.51	2.31	2.54	32.17	62.43	0.55
268	Eight-rowed Yellow	...do	Rep. Midd. Ag'l Exp. St., 1877-'78, p. 29.	11.45	1.36	1.23	38.26	47.62	0.08	1.52	1.38	43.21	53.80	0.09
269	Yellow Western (a)	Illinois	Agriculture of Mass., 1879-'80, p. 250	10.00	0.85	3.26	28.23	57.25	0.41	0.94	3.61	31.37	63.62	0.46
270	Cob meal	Maryland	‡Rep. U. S. Dept. Ag., 1878, p. 136	14.42	1.12	2.33	36.10	45.31	0.72	1.31	2.72	42.18	52.95	0.84
271	Wheeler's Prolific (a)	Massachusetts	Agriculture of Mass., 1879-'80, p. 250	10.00	1.27	3.73	29.87	54.52	0.60	1.40	4.14	33.20	60.59	0.67
272	Southern White (a)	...do	*Ibid.*, p. 250	10.00	0.68	3.14	30.05	55.79	0.34	0.75	3.48	33.38	62.01	0.38
273	Norfolk White	North Carolina	Rep. Ct. Ag'l Exp. St., 1878, p. 72	7.18	1.33	1.81	29.80	59.57	0.31	1.43	1.94	32.10	64.20	0.33
	Average (8 analyses)			9.10	1.32	2.22	32.04	54.85	0.43	1.45	2.44	35.29	60.37	0.45
	Maximum			11.45	2.14	2.69	38.26	59.57	0.92					
	Minimum			7.18	0.96	1.23	29.76	45.31	0.08					

a Not included in the average. Original water content not known.

OATS, KERNEL.

No.	Variety.	State.	Reference.	Analysis. Water.	Ash.	Albuminoids (protein.)	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Calculated water free. Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
274	—, crop of 1877	Connecticut	Rep. Midd. Ag'l Exp. St., 1877-'78, p. 27.	12.36	3.03	8.00	12.89	59.02	4.70	3.46	9.13	14.71	67.34	5.36
275	Common, crop of 1879	...do	U. S. Census	9.40	2.80	10.06	9.67	62.30	5.77	3.09	11.09	10.65	68.82	6.35
276	Common, crop of 1879	...do	*Ibid*	9.27	2.92	9.47	10.11	62.68	5.55	3.21	10.44	11.14	69.10	6.11
277	Common, crop of 1879	...do	*Ibid*	10.72	2.60	9.19	8.88	63.15	5.46	2.91	10.30	9.94	70.74	6.11
278	Common, crop of 1879	...do	*Ibid*	10.30	2.97	9.25	9.87	62.31	5.30	3.31	10.32	11.01	69.45	5.91
279	Common, crop of 1879	...do	*Ibid*	10.86	3.06	9.88	8.94	61.88	5.38	3.43	11.09	10.04	69.41	6.03
280	White, crop of 1879	Dakota	*Ibid*	11.94	3.55	13.00	7.64	58.38	5.49	4.03	14.76	8.68	66.30	6.23
281	—, crop of 1879	...do	*Ibid*	11.55	3.25	12.06	7.23	60.20	5.71	3.68	13.64	8.18	68.04	6.46
282	—, crop of 1879	Illinois	Rep. Midd. Ag'l Exp. St., p. 27	11.23	2.91	11.54	12.18	57.08	5.06	3.28	13.00	13.72	64.30	5.70
283	Bedford, crop of 1879	Massachusetts	U. S. Census	9.81	3.36	12.13	9.37	60.92	4.41	3.73	13.44	10.39	67.55	4.89
284	Common, crop of 1879	Michigan	*Ibid*	12.04	3.20	10.69	8.71	61.04	4.32	3.64	12.16	9.91	69.37	4.92
285	Chinese Hulless	Minnesota	*Ibid*	10.57	2.01	14.10	1.47	66.89	4.96	2.25	15.76	1.64	74.81	5.54
286	Common	New Hampshire	*Ibid*	10.77	3.15	11.56	9.66	60.47	4.39	3.52	12.95	10.83	67.79	4.91
287	State, crop of 1879	New York	*Ibid*	11.03	2.88	10.28	8.76	61.80	5.25	3.24	11.50	9.85	69.45	5.90
288	White State, crop of '79	...do	*Ibid*	10.72	3.00	11.31	8.77	61.26	4.94	3.36	12.68	9.82	68.61	5.53
289	—	...do	*Ibid*	10.56	2.92	13.22	7.37	61.06	4.87	3.26	14.79	8.23	68.30	5.43
290	Schoenen	...do	*Ibid*	9.16	2.36	14.40	10.31	59.09	4.68	2.59	15.85	11.35	65.06	5.15
291	Probestein	...do	*Ibid*	9.72	2.91	13.06	8.10	61.44	4.77	3.23	14.47	8.97	68.05	5.28
292	White Probestein	...do	*Ibid*	8.91	3.22	13.69	9.44	60.65	4.09	3.53	15.04	10.37	66.57	4.49
293	Long Island	...do	*Ibid*	10.31	2.82	11.34	10.79	60.26	4.48	3.14	12.64	12.04	67.18	5.00
	Average (20 analyses)			10.56	2.95	11.41	9.01	61.10	4.97	3.29	12.76	10.07	68.31	5.57
	Maximum			12.36	3.55	14.40	12.89	66.89	5.77					
	Minimum			8.91	2.01	8.00	1.47	57.08	4.09					

OATMEAL.

No.	Variety.	State.	Reference.	Analysis. Water.	Ash.	Albuminoids (protein.)	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Calculated water free. Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
294	From Ireland		U. S. Census	8.84	1.81	12.87	0.66	67.05	8.77	1.99	14.12	0.72	73.55	9.62
295	"C" Akron, Ohio		*Ibid*	6.23	1.99	14.87	0.83	68.09	7.09	2.12	15.86	0.88	73.58	7.56
296	Hickory Nut, New York, crop of 1879.	Iowa	*Ibid*	8.22	1.98	14.19	0.79	68.22	6.60	2.16	15.46	0.86	74.33	7.19
297	Silver Medal, New York, crop of 1879.	Iowa	*Ibid*	8.13	2.17	15.13	1.15	66.62	6.80	2.37	16.47	1.26	72.50	7.40
298	Pin-head, New York, crop of 1879.	Illinois	*Ibid*	8.18	1.86	16.25	0.64	67.02	6.05	2.03	17.70	0.69	72.99	6.59
299	—, New York, crop of 1879.	Illinois	*Ibid*	7.52	2.23	14.63	1.10	67.45	7.07	2.41	15.82	1.19	72.93	7.65
	Average (6 analyses)			7.85	2.01	14.66	0.86	67.56	7.06	2.18	15.91	0.93	73.31	7.67
	Maximum			8.84	2.23	16.25	1.15	68.09	8.77					
	Minimum			6.23	1.81	12.87	0.64	66.62	6.05					

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

BARLEY, KERNEL.

No.	Variety.	State.	Reference.	Analysis.						Calculated water free.				
				Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
300	Nepal (bald), crop of 1879.	California	U. S. Census	11.20	1.82	11.64	1.28	72.37	1.69	2.05	13.11	1.44	81.50	1.90
301	Nepal (bald), crop of 1879.	...do	†Rep. U. S. Dep't Ag., 1878, p. 148	†7.23	1.94	13.17	1.55	72.96	3.15	2.09	14.19	1.67	78.65	3.40
302		Dakota	U. S. Census	12.57	2.43	12.57	3.66	66.97	1.80	2.78	14.37	4.19	76.60	2.06
303	Two-rowed	Massachusetts	*Ibid*	11.87	2.99	8.59	4.17	70.90	1.48	3.40	9.74	4.72	80.46	1.68
304		New Hampshire	*Ibid*	10.32	2.68	12.25	4.21	68.98	1.62	2.98	13.65	4.70	76.86	1.81
305	Pueblo (bald)	New Mexico	*Ibid*	11.12	1.86	15.73	1.40	67.98	1.91	2.10	17.70	1.58	76.47	2.15
306	Four-rowed	New York	*Ibid*	12.43	2.81	12.75	3.15	67.20	1.57	3.21	14.57	3.60	76.83	1.79
307	Two-rowed	...do	*Ibid*	11.00	3.17	14.37	3.25	66.72	1.49	3.56	16.15	3.66	74.96	1.67
308	Four-rowed	Canada	*Ibid*	12.05	2.51	10.62	3.31	60.83	1.68	2.86	12.09	3.78	79.37	1.90
	Average (9 analyses)			11.09	2.47	12.41	2.89	69.32	1.82	2.78	13.96	3.25	77.96	2.05
	Maximum			12.57	3.17	15.73	4.21	72.96	3.15					
	Minimum			7.23	1.82	8.59	1.28	66.72	1.48					

BARLEY PRODUCTS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
309	Pearled barley. No. 3, crop of 1879.	New York	U. S. Census	11.82	0.98	8.44	0.32	77.76	0.68	1.11	9.57	0.36	88.19	0.77
310	Barley meal		Rep. Midd. Ag'l Exp. St., 1877–'78, p. 27.	9.85	3.77	12.68	7.00	63.46	3.24	4.18	14.06	7.76	70.41	3.59

BREWERS' GRAINS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
311	Brewers' grains, fresh		Rep. Midd. Ag'l Exp. St., 1877–'78, p. 38.	75.24	0.29	5.94	3.87	13.19	1.47	1.18	24.06	15.62	53.20	5.92
312	Brewers' grains, fresh		Rep. Conn. B'd Ag., 1872, p. 423	78.50	1.07	4.69	3.11	*a*12.63		4.98	21.81	14.46	*a*58.72	
313	Brewers' grains, fresh		Rep. N. J. Ag'l Exp. St., 1880, p. 46	76.40	0.87	5.56	3.43	11.86	1.88	3.68	23.55	14.53	50.27	7.97
314	Brewers' grains, fresh		*Ibid.*, p. 46	76.23	0.92	5.56	3.55	11.68	2.06	3.87	23.39	14.93	49.15	8.66
	Average (4 analyses)			76.59	0.79	5.44	3.49	11.92	1.77	3.37	23.23	14.90	50.94	7.56
	Maximum			78.50	1.07	5.94	3.87	13.19	2.06					
	Minimum			75.24	0.29	4.69	3.11	11.68	1.47					
315	Dried brewers' grains		Rep. N. J. Ag'l Exp. St., 1880, p. 46	9.72	3.78	17.31	11.63	52.45	5.11	4.19	19.17	12.88	58.11	5.65
316	Dried brewers' grains		‡Rep. U. S. Dep't. Ag., 1878, p. 137	10.24	2.70	21.66	14.88	43.86	6.66	3.01	24.11	16.57	48.89	7.42
317	Kiln-dried brewers' grains.		Rep. Conn. Ag'l Exp. St., 1880, p. 88	2.57	3.97	20.38	11.79	54.89	6.40	4.07	20.92	12.10	56.34	6.57
318	Brewers' grains from Silo.		Rep. N. J. Ag'l Exp. St., 1880, p. 46	66.77	1.44	6.94	5.42	16.86	2.57	4.33	20.88	16.31	50.75	7.73

a The fat not separated.

MALT SPROUTS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
319	Malt sprouts		Rep. Conn. Ag'l Exp. St., 1877, p. 50.	11.55	6.68	25.91	9.30	45.47	1.09	7.54	29.29	10.52	51.52	1.13

RYE, KERNEL.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
320	Common, crop of 1878.	Massachusetts	U. S. Census	12.58	1.87	9.75	1.50	72.91	1.39	2.13	11.16	1.71	83.42	1.58
321	Spring rye	Minnesota	*Ibid*	12.72	1.94	9.50	1.90	72.33	1.61	2.23	10.89	2.18	82.86	1.84
322	Common	New Hampshire	*Ibid*	11.71	1.87	11.69	2.06	71.21	1.46	2.12	13.24	2.34	80.65	1.65
323	Common black	New Jersey	*Ibid*	13.17	1.75	10.29	1.50	71.76	1.53	2.02	11.84	1.73	82.65	1.76
324	White Winter	Pennsylvania	†Rep. U. S. Dep't Ag., 1878, p. 148	8.68	1.87	12.07	1.40	73.91	2.07	2.04	13.21	1.54	80.95	2.26
	Average (5 analyses)			11.77	1.86	10.66	1.67	72.43	1.61	2.11	12.07	1.90	82.10	1.82
	Maximum			13.17	1.94	12.07	2.06	73.91	2.07					
	Minimum			8.68	1.75	9.50	1.40	71.21	1.39					

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

RYE FLOUR.

No.	Variety.	State.	Reference.	Analysis. Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Calculated water free. Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
325	— (Southwick)	Massachusetts	U. S. Census	13.56	0.77	6.63	0.40	77.78	0.86	0.89	7.66	0.46	90.00	0.98
326	— (Danbury)	Connecticut	*Ibid*	12.35	0.72	6.94	0.43	78.67	0.89	0.81	7.94	0.49	89.74	1.02
327			*Ibid*	12.92	0.76	6.00	0.45	79.09	0.78	0.87	6.90	0.52	90.82	0.89
328	— (New Hampton)	New Jersey	*Ibid*	13.58	0.64	7.05	0.35	77.56	0.82	0.74	8.14	0.40	89.77	0.95
	Average (4 analyses)			13.10	0.72	6.65	0.41	78.28	0.84	0.83	7.66	0.47	90.08	0.96
	Maximum			13.58	0.77	7.05	0.45	79.09	0.89					
	Minimum			12.35	0.64	6.00	0.35	77.56	0.78					

RYE BRAN.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
329			Rep. Midd. Ag'l Exp. St., 1877, p. 27	12.88	2.89	12.58	2.54	66.96	2.15	3.32	14.44	2.92	76.85	2.47
330			Rep. Conn. Ag'l Exp. St., 1878, p. 75	10.30	3.54	16.81	4.07	62.68	2.60	3.95	18.74	4.54	69.87	2.90
	Average (2 analyses)			11.59	3.21	14.69	3.31	64.82	2.38	3.63	16.59	3.73	73.36	2.69

BUCKWHEAT, KERNEL.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
331	Silver Hull, crop of 1879	Connecticut	U. S. Census	14.82	2.10	8.58	7.77	64.50	2.23	2.47	10.08	9.12	75.71	2.62
332	Common Gray, crop of 1879.	....do	*Ibid*	13.63	2.34	8.75	8.39	64.70	2.19	2.70	10.14	9.72	74.91	2.53
333	Silver Hull, crop of 1879	Massachusetts	*Ibid*	12.78	1.57	10.06	8.80	64.58	2.21	1.80	11.52	10.08	74.04	2.56
334	Silver Hull, crop of 1879	Minnesota	*Ibid*	11.47	1.83	11.00	8.02	65.37	2.31	2.07	12.42	9.06	73.85	2.60
335	Common Gray, crop of 1879.	New Hampshire	*Ibid*	11.38	2.04	10.18	9.37	64.88	2.15	2.30	11.48	10.58	73.22	2.42
336	Common, crop of 1879	New Jersey	*Ibid*	12.50	2.25	10.41	9.00	63.63	2.21	2.57	11.90	10.28	72.73	2.52
337	Common, crop of 1879	....do	*Ibid*	13.50	2.07	10.71	8.88	62.63	2.21	2.39	12.38	10.26	72.41	2.56
338	Silver-gray, crop of 1879	New York	*Ibid*	10.80	1.99	10.50	9.11	65.12	2.39	2.24	11.78	10.22	73.09	2.67
	Average (8 analyses)			12.62	2.02	10.02	8.67	64.43	2.24	2.32	11.46	9.91	73.75	2.56
	Maximum			14.82	2.34	11.00	9.37	65.37	2.39					
	Minimum			10.80	1.57	8.58	7.77	62.63	2.15					

BUCKWHEAT FLOUR, FARINA, AND GROATS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
339	— (Southwick), crop of 1879.	Massachusetts	U. S. Census	14.94	0.65	4.18	0.21	79.37	0.65	0.76	4.93	0.25	93.30	0.76
340	— (Waterbury), crop of 1879.	Connecticut	*Ibid*	12.84	1.26	8.00	0.35	75.81	1.74	1.45	9.17	0.40	86.98	2.00
341	— (Danbury), crop of 1879.	....do	*Ibid*	12.78	1.26	7.25	0.27	76.85	1.59	1.45	8.31	0.31	88.11	1.82
	Average (3 analyses)			13.52	1.05	6.48	0.28	77.34	1.33	1.22	7.47	0.32	89.46	1.53
	Maximum			14.94	1.26	8.00	0.35	79.37	1.74					
	Minimum			12.78	0.65	4.18	0.21	75.81	0.65					
342	Buckwheat farina, crop of 1879.	New York	U. S. Census	11.23	0.41	3.31	0.13	84.64	0.28	0.46	3.73	0.15	95.34	0.32
343	Buckwheat groats, crop of 1879.	....do	*Ibid*	10.61	0.57	4.82	0.28	83.13	0.59	0.64	5.39	0.31	93.00	0.66

RICE.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
344	Carolina Golden Seed		†Rep. U. S. Dep't Ag., 1879, p. 102	12.93	0.38	8.55	0.17	77.70	0.27	0.44	9.82	0.19	89.24	0.31
345	Carolina White Seed		†*Ibid.*, p. 102	13.31	0.34	8.31	0.13	77.61	0.30	0.39	9.58	0.15	89.53	0.35
346	Japan, fully cleaned		†*Ibid.*, p. 102	13.09	0.43	5.86	0.11	80.23	0.28	0.50	6.75	0.12	92.31	0.32
347	Japan		†*Ibid.*, p. 102	14.02	0.42	7.44	0.17	77.53	0.42	0.49	8.65	0.20	90.17	0.49
348	Patna, Bengal		†*Ibid.*, p. 102	12.85	0.35	7.70	0.14	78.64	0.32	0.40	8.84	0.16	90.23	0.37
349	Rangoon		†*Ibid.*, p. 102	11.45	0.34	7.35	0.19	80.28	0.39	0.39	8.30	0.21	90.66	0.44
350	Bassein, F. India		†*Ibid.*, p. 102	11.38	0.48	8.40	0.19	78.93	0.62	0.54	9.47	0.21	89.08	0.70
351	White seed	Louisiana	†*Ibid.*, p. 102	12.16	0.33	6.65	0.19	80.40	0.27	0.38	7.57	0.22	91.52	0.31
352	Honduras	....do	†*Ibid.*, p. 102	11.80	0.34	7.26	0.19	80.11	0.30	0.39	8.23	0.22	90.82	0.34
353	Volunteer	....do	†*Ibid.*, p. 102	11.45	0.40	6.83	0.40	80.55	0.37	0.45	7.72	0.45	90.96	0.42
	Average (10 analyses)			12.44	0.38	7.44	0.19	79.20	0.35	0.44	8.49	0.21	90.45	0.41
	Maximum			14.02	0.48	8.55	0.40	80.55	0.62					
	Minimum			11.38	0.33	5.86	0.11	77.53	0.27					
354	Rice meal		Rep. Midd. Ag'l Exp. St., 1877-'78, p. 27.	15.11	6.03	9.25	8.12	59.88	1.61	7.10	10.94	9.56	70.50	1.90

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

SORGHUM SEED.

No.	Variety.	State.	Reference.	Analysis. Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Calculated water free. Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
355	Early Amber		†Rep. U. S. Dep't Ag., 1879, p. 64	10.57	1.81	9.98	1.48	71.59	4.60	2.01	11.17	1.66	80.01	5.15
356	Chinese		†*Ibid.*, p. 64	9.93	1.47	9.54	1.52	73.59	3.95	1.64	10.59	1.68	81.71	4.38
357		Connecticut	LI Bull. Ct. Ag'l Exp. St	16.76	2.17	7.67	3.21	66.81	3.36	2.60	9.23	3.85	80.30	4.02
358	Minn. Early Amber	Massachusetts	*Ibid*	15.04	1.73	8.13	1.94	69.65	3.51	2.04	9.57	2.28	81.98	4.13
	Average (4 analyses)			13.08	1.79	8.83	2.04	70.41	3.85	2.07	10.14	2.37	81.00	4.42
	Maximum			16.76	2.17	9.98	3.21	73.59	4.60					
	Minimum			9.93	1.47	7.67	1.48	66.81	3.36					

MISCELLANEOUS CEREALS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
359	Chinese corn		†Rep. U. S. Dep't Ag., 1879, p. 101	7.87	1.46	9.63	1.79	75.50	3.75	1.58	10.45	1.96	81.95	4.06
360	Brown durra		†*Ibid.*, p. 101	7.62	1.68	9.01	1.52	75.99	4.18	1.81	9.75	1.64	82.26	4.54

STRAW.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
361	Wheat straw		Rep. N. J. Ag'l Exp. St., 1880, p. 47	7.78	3.17	2.19	37.32	47.01	2.53	3.44	2.38	40.48	50.96	2.74
362	Oat straw	Connecticut	Rep. Midd. Ag'l Exp. St., 1877-'78, p. 37.	*a*12.50	1.81	2.30	55.96	26.42	1.00	2.07	2.63	63.96	30.19	1.15
363	Rye straw	do	Rep. Midd. Ag'l Exp. St., 1877-'78, p. 37.	*a*12.50	8.03	6.89	34.20	35.70	2.68	9.18	7.88	39.08	40.82	3.04
364	Buckwheat straw		Bull. Bussey Inst., 1877, p. 54	10.35	4.94	4.38	46.83	32.08	1.42	5.52	4.91	52.28	35.71	1.58
365	Buckwheat straw		*Ibid.*, p. 54	10.39	5.16	3.33	44.93	34.49	1.70	5.76	3.72	50.12	38.51	1.90
	Average (2 analyses)			10.37	5.05	3.86	45.88	33.28	1.56	5.64	4.32	51.20	37.61	1.74

a Reckoned to this per cent. by the analyst for comparison.

CORN FODDER AND STOVER—FRESH.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
366	Sweet corn (before tassel), crop of 1877.	Connecticut	Rep. Conn. Ag'l Exp. St., 1878, p. 60.	92.908	0.980	0.866	1.903	3.198	0.145	13.82	12.22	26.84	45.08	2.04
367	Sweet corn (in silk), crop of 1877.	do	*Ibid.*, p. 60	88.289	1.269	1.310	3.227	5.736	0.169	10.84	11.19	27.45	49.08	1.44
368	Sweet corn (in the milk), crop of 1877.	do	*Ibid.*, p. 60	90.480	1.104	0.864	2.694	4.719	0.139	11.59	9.08	28.30	49.57	1.46
369	Sweet corn (fully ripe), crop of 1877.	do	*Ibid.*, p. 60	80.740	2.334	1.538	5.939	9.207	0.244	12.12	7.89	30.78	47.94	1.27
370	Southern White		Rep. Mid. Ag'l Exp. St., 1877-78, p. 35	*a*85.700	0.94	1.270	4.600	7.280	0.210	6.55	8.87	32.17	50.91	1.50
371	Southern White		*Ibid.*, p. 35	*a*85.700	1.23	1.200	4.950	6.730	0.180	8.62	8.44	34.66	46.98	1.30
372	Southern White		*Ibid.*, p. 35	*a*85.700	1.00	1.480	4.310	7.370	0.140	6.97	10.38	30.16	51.48	1.01
373	Norfolk White (corn fodder), crop of 1874.	Connecticut	Am. Jour. Sci. & Arts, 1877, p. 203	87.180	0.84	0.880	4.380	6.440	0.280	6.57	6.87	34.19	50.23	2.14
374	Norfolk white (corn fodder), crop of 1874.	do	*Ibid.*, p. 203	85.040	0.74	0.780	5.160	8.060	0.220	4.95	5.19	34.45	53.95	1.46
	Average (9 analyses)			86.860	1.160	1.130	4.130	6.530	0.190	9.11	8.91	31.00	49.47	1.51
	Maximum			92.908	2.334	1.538	5.939	9.207	0.280					
	Minimum			80.740	0.740	0.780	1.903	3.198	0.139					

a Reckoned to this per cent. by the analyst for comparison.

CORN FODDER AND STOVER—FIELD CURED OR DRIED.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
375	Ohio Dent (stover), crop of 1877.	Connecticut	Rep. Conn. Ag'l Exp. St., 1878, p. 60.	36.490	2.874	4.623	19.077	35.781	1.155	4.52	7.28	30.04	56.36	1.80
376	Norfolk White (corn fodder), crop of 1874.	do	Am. Jour. Sci. & Arts, 1877, p. 203	27.590	4.760	4.970	24.760	36.370	1.550	6.57	6.86	34.19	50.24	2.14
377	Norfolk White (corn fodder), crop of 1874.	do	*Ibid.*, p. 203	26.920	3.620	3.700	25.180	39.420	1.070	4.95	5.17	34.46	53.96	1.46
378	White Flint (stover), crop of 1877.	do	Rep. Conn. Ag'l Exp. St., 1879, p. 80.							5.13	7.57	33.06	52.49	1.75
379	Fodder corn		Rep. N. J. Ag'l Exp. St., 1880, p. 47	14.960	5.950	3.390	25.360	49.160	1.180	7.01	4.00	29.80	57.78	1.41
	Average (4 analyses)			29.480	3.750	4.730	23.290	37.490	1.260	5.31	6.70	33.02	53.17	1.79
	Maximum			36.490	4.760	5.530	25.180	39.420	1.550					
	Minimum			14.960	5.950	3.390	25.360	49.160	1.180					

TABLE XXV.—CHEMICAL COMPOSITION OF AMERICAN CEREALS AND CEREAL PRODUCTS—Continued.

ENSILAGED CORN FODDER.

No.	Variety.	State.	Reference.	Analysis. Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Calculated water free. Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
380		Connecticut	XI Bulletin N. J. Exp. St.	82.10	1.02	1.21	5.84	9.62	0.71	5.70	6.76	29.83	53.75	3.96
381		...do	*Ibid*	83.56	0.81	1.06	5.76	8.08	0.73	4.92	6.45	35.04	49.15	4.44
382		...do	LV Bulletin Conn. Ag'l Exp. St.	82.00	1.04	1.27	5.70	9.50	0.34	5.84	7.07	32.15	53.03	1.91
383		Maryland	XI Bulletin N. J. Exp. St.	78.51	1.53	0.88	6.43	12.03	0.62	7.11	4.09	29.92	56.00	2.88
384		Massachusetts	*Ibid*	84.87	0.98	1.06	5.61	7.03	0.45	6.47	7.00	37.08	46.48	2.97
385		...do	Country Gentleman, Dec. 9, 1880	80.70	1.77	1.56	6.43	8.92	0.62	9.17	8.08	33.32	46.22	3.21
386		New Jersey	XI Bulletin N. J. Exp. St.	77.41	1.00	1.02	6.85	13.04	0.68	4.43	4.52	30.32	57.72	3.01
387		...do	*Ibid*	83.52	1.43	0.94	5.18	8.28	0.65	8.67	5.70	31.43	50.26	3.94
388		...do	*Ibid*	84.28	1.26	1.37	4.68	7.91	0.50	8.01	8.72	29.77	50.32	3.18
389		New York	*Ibid*	80.86	1.00	1.27	5.47	10.73	0.67	5.22	6.57	28.57	56.14	3.50
390		...do	*Ibid*	83.54	1.40	1.06	5.85	7.65	0.50	8.50	6.44	35.41	46.58	3.04
	Average (11 analyses)			81.05	1.21	1.15	5.76	9.34	0.59	6.73	6.49	32.08	51.42	3.28
	Maximum			84.87	1.77	1.56	6.85	13.04	0.73	......	......	......	......	......
	Minimum			77.41	0.81	0.88	4.68	7.03	0.34	......	......	......	......	......

SORGHUM LEAVES.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
391	Early Amber		*Rep. U. S. Dep't Ag., 1879, p. 57	75.00	3.87	3.28	4.50	*a*13.35	......	15.49	13.14	17.98	*a*53.39	......
392	Honduras		**Ibid.*, p. 57	76.70	3.28	2.43	4.31	*a*13.28	......	14.08	10.43	18.51	*a*56.98	......
393	Egyptian sugar corn		**Ibid.*, p. 57	67.30	3.41	3.71	6.81	*a*18.77	......	10.44	11.34	20.83	*a*57.39	......
	Average (3 analyses)			73.00	3.52	3.14	5.21	*a*15.13	......	13.34	11.64	19.10	*a*55.92	......
	Maximum			76.70	3.87	3.71	6.81	*a*18.77	......	......	......	......	......	......
	Minimum			67.30	3.28	2.43	4.31	*a*13.28	......	......	......	......	......	......

a The fat not separated, but reckoned with the carbhydrates.

SORGHUM—STRIPPED STALKS.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
394	Early Amber		*Rep. U. S. Dep't Ag., 1879, p. 57	75.70	1.59	1.20	3.89	*a*17.62	......	6.55	4.95	16.01	*a*72.49	......
395	Honduras		**Ibid.*, p. 57	80.00	0.89	0.96	3.30	*a*14.85	......	4.46	4.81	16.48	*a*74.25	......
396	Egyptian sugar corn		**Ibid.*, p. 57	84.90	0.90	1.04	2.99	*a*10.17	......	5.96	6.90	19.82	*a*67.32	......
	Average (3 analyses)			80.20	1.13	1.07	3.39	*a*14.21	......	5.66	5.55	17.44	*a*71.35	......
	Maximum			84.90	1.59	1.20	3.89	*a*17.62	......	......	......	......	......	......
	Minimum			75.70	0.89	0.96	2.99	*a*10.17	......	......	......	......	......	......

a The fat not separated.

SORGHUM—BAGASSE.

No.	Variety.	State.	Reference.	Water.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.	Ash.	Albuminoids (protein).	Fiber.	Carbhydrates (starch, gum, etc.).	Fat.
397	Early Amber		*Rep. U. S. Dep't Ag., 1879, p. 57	83.70	0.63	0.65	3.11	*a*11.92	......	3.80	3.96	19.10	*a*73.14	......
398	Honduras		**Ibid.*, p. 57	84.00	0.60	0.62	3.31	*a*11.47	......	3.75	3.87	20.66	*a*71.72	......
399	Egyptian sugar corn		**Ibid.*, p. 57	88.70	0.55	0.68	2.83	*a*7.24	......	4.87	6.04	25.00	*a*64.09	......
	Average (3 analyses)			85.46	0.59	0.65	3.08	*a*10.22	......	4.14	4.62	21.59	*a*69.65	......
	Maximum			88.70	0.62	0.68	3.31	*a*11.92	......	......	......	......	......	......
	Minimum			83.70	0.55	0.62	2.83	*a*7.24	......	......	......	......	......	......

a The fat not separated.

NOTES PERTAINING TO SOME OF THE ANALYSES OF THE PRECEDING TABLE.

No. 2. "Milling Extra, Detroit inspection." The figures given in the reference cited differ from those given here, having been corrected by the analyst. The same is true of Nos. 115, 116, 117, 118, 268, and 282.

No. 3. Is "No. 1 White Winter" of the New York Produce Exchange inspection.

No. 19. Grown on "limestone land", northern New Jersey.

No. 20. Grown on "gray rock gravel soil", northern New Jersey, and considered by local millers to be the best New Jersey wheat.

No. 21. White Winter, Orleans county, New York. Grown with the use of phosphates, and "averaging 30 or 35 bushels per acre". Grains plump, 12,236 grains per pound, or 734,160 grains per bushel of 60 pounds, and of the grade from which the flour No. 105 is made.

No. 42. Red Winter, Orleans county, New York. Grown with phosphates, and yielding 30 bushels per acre. Grains small; 16,200 grains per pound; 972,000 grains per bushel.

No. 49. Fultz, winter. Grown on the farm of the State University of Wisconsin.

No. 57. "No. 2 Red Winter" of the New York Produce Exchange inspection. Not plump; runs about 14,277 grains to the pound, equal to 856,620 grains per bushel.

No. 58. "Macaroni" wheat, Chico, California. A very hard wheat; grains very long and large, running about 7,781 grains per pound, or 466,860 grains per bushel.

No. 59. "Macaroni" wheat, San Joaquin valley, California, from seed said to have come originally from Chili. Much like the last in looks; 7,443 grains per pound, or about 446,580 grains per bushel.

No. 60. "White Club," Chico, California.

No. 61. "No. 1" (white), as graded by the grain standard committee of the San Francisco Produce Exchange.

No. 62. "Scotch Fife," spring; Barnes county, Dakota. "Yield, 30 bushels per acre; weight, 63 pounds per bushel; soil, black sandy loam."

No. 63. "Scotch Fife," spring; Cass county, Dakota. "Yield, 31 bushels per acre; weight, 62 pounds per bushel; soil, black sandy loam."

No. 64. "Amber Bearded," spring. Grown on "high, strong soil", Androscoggin county, Maine. Color, dark; 13,743 grains per pound; 824,580 grains per bushel.

No. 70. "Red Mammoth," spring. Grown on the farm of the State University of Wisconsin.

Wheat flour Nos. 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 108, 109, 110, 111, 121, 122, and 123 were bought in the markets, and the brands and sources are those under which the public bought them.

No. 100. Purports to be made of the "entire wheat", only the outer cuticle removed. (This cuticle is the bran, No. 124, of these tables.) All the rest of the kernel goes in and is ground fine; is not a Graham flour. It is a very strong flour; makes bread of excellent quality, very light in texture, but is much darker in color than would be inferred from the color of the flour. Made at Franklin Mills, Lockport, New York.

No. 101. "Baking Flour," patent. Purports to be of all spring wheat; manufactured at Milwaukee, Wisconsin.

No. 102. "Perfection," made by the Yeager Milling Company, St. Louis, Missouri.

No. 103. "White Silk," a straight flour, and popular for pastry, St. Louis, Missouri.

No. 104. "Snowflake," an excellent pastry flour, made at Greenville City Mills, Greenville, Montcalm county, Michigan.

No. 105. "Hill's XXXX," made at Medina Falls Flouring Mills, Medina, Orleans county, New York, of white winter wheat grown in that region (No. 21 of these tables), and is a popular family flour.

No. 106. "Bluejacket," made at the same mills with the last from red winter wheat (No. 42 of these tables), and is a very strong flour.

No. 107. Made from New Jersey wheat at the Imlaydale Mills, New Hampton, Hunterdon county, New Jersey.

[Nos. 105, 106, and 107 were obtained from the manufacturers, and not in the markets.]

No. 108. "Superlative," patent, Washburn, Crosby & Company, Minneapolis, Minnesota.

No. 109. "Palisade" straight, Theonard, Day & Co., Minneapolis, Minnesota.

No. 110. "Early Riser," patent, made at Sparta, Randolph county, Illinois.

No. 111. "Bain's Choice," straight, made by the Atlantic Milling Company, St. Louis, Missouri.

Nos. 115, 116, 117, and 118, see note under No. 2.

No. 119. Bought in the market, and purporting to be made from Minnesota spring wheat.

No. 121. Graham flour, Rochester, New York.

No. 122. Graham flour, Honeoye, Ontario county, New York.

No. 123. "Kelly's No. 1 Graham flour," Rochester Hygienic Mills, Rochester, New York.

No. 124. This is the bran removed from the entire wheat, No. 100. It is the least nutritious of all the brans analyzed and recorded in these tables.

No. 145. White pop-corn, grown in Hartford county, Connecticut, four years old at the time of analysis; nearly every grain pops on roasting.

No. 154. "Waushakum," Middlesex county, Massachusetts, a very firm, flinty, heavy flint corn, much of which pops on roasting.

Nos. 156, 157, 158, 159, and 160. The figures here given are those found by actual analysis, and differ from those published in the reference cited, where they (along with analyses Nos. 269, 271, and 272) are calculated to a uniform standard of 10 per cent. water.

No. 178. An eight-rowed White and Yellow pop-corn, mixed, from Tompkins county, New York.

No. 193. "Yellow Dent," Chico, Butte county, California.

No. 214. "Yellow Dent," Becker county, Minnesota, grown on black sandy loam.

No. 219. Immature sweet corn, in the "blister" stage, and before quite fit for "boiling ears". The entire plant, as cut up for fodder at this stage, is represented in analysis No. 367, and of the cob, No. 260.

No. 220. Immature sweet corn, just the right stage for boiling as "green corn". The composition of the whole plant, as cut up for fodder or soiling, at this date, is given in analysis No. 368, and of the cob, No. 261.

No. 221. Ripe sweet corn, of same kind and cultivation as the last two samples. The composition of the entire plant is given in analysis No. 369. For full information respecting this and the two preceding analyses consult Nos. 219, 220, 221, 260, 261, 262, 366, 367, 368, and 369, in Table XXV.

No. 239. A peculiar white-grained starchy corn, grown with irrigation, by the Pueblo Indians, at Taos, New Mexico.

No. 240. From the same locality, very deep red or almost black in color, but the interior white; the favorite corn with the Indians for making cakes, and the variety is said to have been cultivated from time immemorial.

No. 245. "Hominy," manufactured by Miles & Holman, New York, "from choice southern corn, crop of 1879." Obtained from the manufacturers.

No. 246. "Hominy," same manufacturers, "from Indiana white corn, crop of 1879."

Nos. 252 and 253. The kind not stated in the place cited.

Nos. 260, 261, and 262 are the cobs from the same samples of corn cited under analyses Nos. 219, 220, 221, 366, 367, 368, and 369.

No. 268. See note under No. 2.

Nos. 269, 271, and 272. The figures here given are those published in the place cited, and have the water calculated to a uniform standard of 10 per cent. See notes under Nos. 156, 157, etc.

Nos. 275, 276, 277, 278, and 279 are from different localities in Litchfield county, Connecticut. As a whole, they are poor in albuminoids. These were all grown by good farmers.

No. 280. White oats, Red River valley, Cass county, Dakota; soil, black loam; yield, 58 bushels per acre; weight, 36 pounds per bushel.

No. 281. Oats, Barnes county, Dakota; "upland prairie; soil, dark loam, 20 inches deep; yield, 85 bushels per acre; weight, 41 pounds per bushel."

No. 282. "No. 1 White Oats, probably Illinois." See also note under No. 2.

No. 283. Bedford oats, grown in eastern Massachusetts, and alleged to weigh 40 pounds per bushel; apparently weighs 35 or 36 pounds. Sold in the seed-stores in Boston for seed.

No. 284. Sold in the seed-stores of New Haven as "Michigan Oats" for local use for seed.

No. 286. Oats "of the common sort", grown on the college farm at Hanover, New Hampshire; weight, 32 pounds per bushel.

Nos. 287, 288, and 289. The term "State Oats" is used in New England as well as in New York to designate oats grown in the state of New York excepting Long Island.

No. 287. Sold in the feed-stores of New Haven as "State Oats", grown in northern New York; weight, about 32 pounds per bushel.

No. 288. White "State Oats", purporting to have been grown in western New York.

No. 289. Common oats, grown on the highlands in Tompkins county, New York.

No. 290. "Schoenen" oats, from New York state, purchased in the seed-stores of New York.

No. 291. "Probestein" oats, Seneca county, New York; weighs 37 pounds per bushel. Probably the name and origin is the "*Probestei*" oats of Germany.

No. 292. "White Probestein," New York state.

No. 293. Heavy oats from the eastern end of Long Island, where the variety has been cultivated for many years under no particular name; weighs 42 pounds per bushel.

No. 294. Irish oatmeal, Watergate mills, Dublin, Ireland.

No. 295. "Pin-head" oatmeal, "brand C," manufactured by F. Schumacher, Akron, Ohio.

No. 296. "Hickory Nut" oatmeal, manufactured from Iowa oats, crop of 1879, by Miles & Holman, New York.

No. 297. "Silver Medal" oatmeal, manufactured from Iowa oats, same firm as above.

No. 298. "Pin-head" oatmeal, manufactured from Illinois oats, crop of 1879, by same firm.

No. 299. Manufactured from Illinois oats, crop of 1879, by same firm.

[Oatmeals 294 and 295 were bought in the markets; 296, 297, 298, and 299 were direct from the manufacturers.]

No. 300. Nepal (bald) barley, Chico, Butte county, California.

No. 302. Barley, Red River valley, Cass county, Dakota. "Soil, black loam; yield, 40 bushels per acre; weight, 50 pounds per bushel."

No. 303. Two-rowed barley, from Essex county, eastern Massachusetts.

No. 304. From the state agricultural college farm at Hanover, New Hampshire.

No. 305. A skinless barley, grown by the Pueblo Indians at Taos, New Mexico, with irrigation. It is the richest American grain in albuminoids yet analyzed.

No. 306. Four-rowed barley, from Seneca county, New York; weight, 49 pounds per bushel.

No. 307. Two-rowed barley, from Seneca county, New York; weight, 52 pounds per bushel.

No. 308. Canada barley, brought into New England for seed.

No. 309. "Pearled Barley, No. 3," manufactured by Miles & Holman, of New York, from New York state two-rowed barley.

No. 320. Common rye, Middlesex county, Massachusetts.

No. 321. Spring rye, from Wadena county, Minnesota. "Soil, black sandy loam; yield, 28.5 bushels per acre; weight, 58 pounds per bushel."

No. 322. Common rye from the state agricultural college farm, Hanover, New Hampshire.

No. 323. Common black rye, Cumberland county, New Jersey.

No. 325. Rye flour, manufactured at Southwick, Hampden county, Massachusetts, and purporting to be from rye of that region.

No. 326. Rye flour manufactured at Danbury, Connecticut.

No. 327. Rye flour bought in the market; of unknown origin.

No. 328. Rye flour made from New Jersey rye at the Imlaydale mills, New Hampton, New Jersey.

[Nos. 325, 326, and 327 were bought in the market; 328 and 329 were obtained from the manufacturer.]

No. 331. Silver Hull buckwheat, New Haven county, Connecticut.

No. 332. Common gray buckwheat, Guilford, Connecticut.

No. 333. Silver Hull buckwheat, Massachusetts, purporting to weigh 54 pounds per bushel.

No. 334. Silver Hull buckwheat, bought in the seed-stores at New York, and purporting to have been grown in Minnesota.

No. 335. Common gray buckwheat from the state agricultural college farm at Hanover, New Hampshire.

No. 336. Common buckwheat from New Jersey, alleged to weigh 49 pounds per bushel.

No. 337. Common buckwheat from Cumberland county, New Jersey.

No. 338. Silver-gray buckwheat, Tompkins county, New York. Not so plump as usual in this locality.

No. 339. Buckwheat flour made at Southwick, Hampden county, Massachusetts.

No. 340. Buckwheat flour made by the Platt Milling Company, Waterbury, Connecticut.

No. 341. Buckwheat flour manufactured by Crofut & Sons, Danbury, Connecticut.

No. 342. Buckwheat farina, manufactured from New York state buckwheat, crop of 1879, by Miles & Holman, New York.

No. 343. Buckwheat groats, same origin with last.

[Nos. 339, 340, and 341 were bought in the market; 342 and 343 were furnished by the manufacturers.]

No. 357. The analysis republished later in the Rep. Conn. Ag'l Exp. Station for 1881, p. 82.

No. 366. Cut just before the tassels appeared (July 25, 1877).

No. 367. Cut (from the same field) fifteen days later (August 9), when in full silk. The composition of the immatured kernels is given in 219.

No. 368. Cut sixteen days later (August 25), the kernels full size for eating as "green corn". Their composition is given in analysis No. 220.

No. 369. Cut one month later (September 25), when the stalks and ears were ripe and nearly dry. The analyses for these four samples represent the entire plant, leaves, tassel, stalk, ear, and husk—the whole plant, except the stubble and roots, which were rejected. The composition of the ripe kernels is given in analysis No. 221.

[Nos. 366, 367, 368, and 369 represent the composition of the entire corn plant at different stages of growth, and the analyses Nos. 219, 220, and 221 represent the composition of the kernel, and 260, 261, and 262 of the cob, at the same stages. The variety was medium, a large variety of sweet corn, and was grown by T. S. Gold, esq., secretary of the Connecticut State Board of Agriculture, in Litchfield county, Connecticut. It was planted in rich, well-manured soil, June 1, 1877, the hills 2½ feet apart in the rows, and the rows 3 feet from each other, making 4,800 hills per acre. For fuller description, see reference cited.]

Nos. 373 and 376 are analyses of maize fodder grown in southern Connecticut from Norfolk white corn, raised on an inverted sod, long-tilled ground with the help of stable manure. The seed was sown in drills 24 inches apart, 3 bushels per acre. When harvested, the stalks had an average height of 10 or 12 feet, many of them measuring 14 feet, with a very uniform diameter of rarely more than eleven-sixteenths of an inch. The yield amounted to 54,723 pounds fresh, or 9,583 pounds field-cured fodder.

Nos. 374 and 377 are of the same variety, same cultivation and treatment, except that it was taken from new ground which had borne two rye crops, was seeded, had been in pasture for five years, was then plowed, and had carried two successive crops of corn fodder, of which this was the last. On this ground no stable manure had ever been applied. The yield amounted to 51,074 pounds per acre fresh, or 10,454 pounds field-cured.

No. 375 is corn stover. (Stover is the stalks, leaves, and husks from which the ripe corn has been husked.) Dent corn raised on the same farm with the last analysis of corn fodder.

No. 378. White flint stover. In the publication cited for this analysis the figures seem different from this, because it there appears in a table in which several analyses are calculated to one water content. Here the analysis is given calculated water-free, and of course both are then the same.

Nos. 380 and 381. Republished later in Rep. N. J. Ag'l Exp. Station for 1881, p. 55. The figures here given are those of the original bulletin, and in analysis 381 differ from those in the later report.

No. 382. Republished later in Rep. Conn. Ag'l Exp. Station for 1881, p. 89.

METHOD OF ANALYSIS.

Inasmuch as the value and the accuracy of chemical analyses depend as well upon the methods pursued as upon the skill and the knowledge of the chemist, the method pursued by Mr. Penfield in making the analyses for the Census Office is here briefly sketched. It is the same as that used by Professor S. W. Johnson, of the Sheffield Scientific School of Yale College, in the laboratory of that institution, and also in the laboratory of the Connecticut Agricultural Experiment Station, which is under his direction, and is the method usually employed in the various agricultural experiment stations, both in America and in Europe.

PREPARATION OF THE SAMPLE.—A fair sample of the material to be analyzed (grain, flour, or other mill product), of a pound, more or less, is taken for analysis and kept hermetically sealed to prevent any change in its hygroscopic condition during the time it is under investigation. If of grain or other coarse product, the whole sample is ground and reground in an iron mill until it all passes through a sieve with meshes one twenty-fifth of an inch in diameter, or, in case of such as have a tough husk, like oats and barley, the ultimate sifting is through meshes one-sixteenth of an inch in diameter. The ground sample is thoroughly mixed and then tightly closed in a glass vessel, and portions of it are used for the various determinations.

THE DETERMINATION OF ASH.—Three grams are burned to ashes in a platinum tray in a gas muffle-furnace. The temperature is kept below full redness until the carbon is completely burned away, and the ash is weighed directly.

DETERMINATION OF ALBUMINOIDS.—Nitrogen is determined by the soda-lime process in the usual way, and the per cent. of nitrogen found is multiplied by the usual factor, 6¼, and the product is reckoned as the percentage of albuminoids.

DETERMINATION OF FIBER.—Three grams are boiled for half an hour in a large flask with 200 cubic centimeters of 1¼ per cent. sulphuric acid, adding water from time to time to replace what is lost by evaporation. After the boiling, the flask is placed in an inclined position until its contents have settled. Then the liquid is decanted as completely as is practicable. Two hundred cubic centimeters of water are then added to the residue in the flask and again boiled for half an hour. The liquid is decanted as before, and the residue is again boiled half an hour with 200 cubic centimeters of water, and again decanted. The solutions obtained in these successive decantations are united and allowed to stand and settle, and any particles of fiber separating from them are transferred to the flask. Two hundred cubic centimeters of 1¼ per cent. solution of caustic potash are now poured into the flask, and the whole is boiled for half an hour. Then the liquid is allowed to settle, is decanted as before, and the residue is washed by boiling for half an hour with successive portions of distilled water, precisely as described above.

The undissolved fiber is then collected on an asbestus filter in a Gooch crucible, washed first with hot water, then with acidulated water, then again with water, then with alcohol, and finally with ether. It is dried at 100° C. (212° F.) and weighed. The whole is then ignited, and the weight of the ash found is deducted from the weight of the fiber.

The albuminoids, if any, existing in the fiber are neglected in the analyses cited above, experiment proving that the amount is too insignificant to be of importance. Several examinations of the fiber from buckwheat showed an amount of albuminoids equal to only 0.07 per cent. of the meal used. Wheat bran gave 0.04 per cent.; oats and barley none. The fiber reckoned above is the "crude fiber" of chemists, sometimes called also "woody fiber" and "cellulose" by different writers. It is found chiefly in the bran or husk.

DETERMINATION OF WATER.—Two grams of the material are dried in a vacuum at a temperature of 110° C. (230° F.), and the water is calculated from the loss in weight. The method is as follows:

A rectangular copper water-bath is used, supplied with a solution of sodium nitrate of such strength as to boil at 110° C. (230° F.). This water-bath has a single opening, into which a condenser is fitted, which condenses the steam and returns it, thus keeping the solution of the same strength and its boiling point constant. In the top of the bath are four cylindrical closed dry wells, reaching well down into the boiling solution. The weighing flasks, containing the material to be dried, fit closely into these wells, and are connected by means of rubber stoppers and suitable connections with an air-pump. (A Richards filter-pump was used in these analyses to produce a vacuum.) The drying by this means is usually complete in six hours.

DETERMINATION OF FAT.—The dry material obtained in determining the water is transferred to a fat extractor furnished with a weighed flask, and the fats are extracted with anhydrous ether for five or six hours. The flask with the fat is dried at 100° C. and weighed. It is unnecessary to describe the apparatus in detail, further than to say that the ether is volatilized and condensed over and over again, the condensed product returning through the material from which the fat is to be extracted.

DETERMINATION OF CARBHYDRATES.—The carbhydrates are not determined directly. The difference between the sum of all the per cents obtained in the other ingredients and 100 per cent. is reckoned as carbhydrates.

COST AND METHODS OF PRODUCTION.

SPECIAL SCHEDULE.

To elicit information the following special schedule was addressed to prominent farmers in every county in the grain-growing states and in nearly every county in the United States, frequently to several persons in the same county, embracing the correspondents of the United States Department of Agriculture and other farmers, the officers of agricultural societies, etc., whose names were accessible to this office. The answers were very numerous, and in most cases apparently compiled with care, but, as might be reasonably expected, were most conflicting in all details in which quantity and cost were involved. So far as possible, the answers have been used in the preparation of this report. The inherent difficulty of giving exact data as to the cost of production is discussed later:

[Tenth census of the United States.]

RETURNS UPON THE PRODUCTION OF CEREALS.

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE,
Washington, D. C., April 6, 1880.

In accordance with the provisions of the act of Congress approved March 3, 1879, Professor William H. Brewer, Sheffield Scientific School, New Haven, Connecticut, has been appointed the special agent of the Census Office to have charge of the inquiry into the statistics of the production of cereals. The special agent thus appointed has all the authority of a census enumerator under the act of March 3, 1879, and is empowered to conduct in his own name the correspondence relating to the foregoing branch of agriculture.

All persons to whom he may address these inquiries are requested to return their answers to this office, for which purpose a stamped envelope is herewith inclosed.

FRANCIS A. WALKER,
Superintendent of Census.

PRODUCTION OF CEREALS.

Persons receiving this schedule are requested to enter their answers in the blank spaces after the questions. Any further information (not called forth by the questions) relating to the production of cereals, and which may be deemed important in the locality described, may be given in such shape as the writer chooses.

A.—LOCATION.

1. State: ; county: ; town:
2. What proportion of the land devoted to grain-raising is—
   Hilly?
   Rolling?
   Level, alluvial, or bottom land?
3. What is the prevailing kind of soil (as clay, loam, alluvial, black prairie, etc.)?
4. What is the character of the subsoil?
5. Was the land originally covered with forest or prairie?
6. What is the average value per acre of the grain farms of your region?
7. What proportion of the grain farms are managed by their owners, and what by tenants?

8. What proportion of the hired labor of the grain farms is hired by the month or year?
What proportion is hired by the day?
9. What proportion of the hired laborers on the grain farms board with their employers?
10. What is the leading agricultural industry? Grain-growing, cotton-planting, sugar-planting, grazing.
11. What are the four most important grain crops grown in your region? (State them in their order, the most important first.)
12. Is there any one system of rotation of crops generally practiced? If so, what is the rotation?
13. How long since the region was settled and brought into general cultivation?

B.—Wheat.

14. How does the *yield of wheat per acre* in 1879 compare with the yield in 1878?
With that of 1877?
15. How does the *quality* of the crop of 1879 compare with that of 1878?
With that of 1877?
16. What is usually considered a *fair yield* to be anticipated in your region of winter wheat (bushels per acre)?
Of spring wheat?
17. What was the *largest* yield per acre you know of in your region in 1879?
18. What varieties of winter wheat are most commonly grown?
19. What of spring wheat?
20. What was the average *weight* per measured bushel of the winter wheat of the crop of 1879?
21. Of the spring wheat?
22. Is more wheat grown in your region than is needed for local consumption?

PREPARATION OF THE SOIL.

23. What proportion of the soil is plowed more than once in preparing for wheat?
24. What is the usual depth (in inches) of plowing for wheat?
25. What is an average day's work for man and team in plowing?
26. What is the price per acre for contract plowing?
a. Breaking prairie.
b. Breaking meadow or pasture sod.
c. Breaking stubble or fallow land.
27. What proportion of the acreage of wheat grown in 1879 has any manure or fertilizer whatever applied to the crop?
28. What proportion of the acreage had any fertilizer applied other than that produced on the farm?

SOWING.

29. What date is preferred for sowing winter wheat in your region?
30. How early and how late may it be sown with reasonable expectation of a profitable crop?
31. What date is preferred for sowing spring wheat?
32. How early and how late may it be sown?
33. What proportion of all the wheat grown in your region is sown by hand, and what by some kind of machine or drill?
34. What proportion is sown broadcast, and what proportion is in drills?
35. If either way is preferred, state why.
36. When sown by hand, what is an average day's work?
37. When drilled in or sown with machine, what is an average day's work for man and team?
38. How much seed is usually used per acre when drilled in?
How much when sown broadcast?
39. Is there usually any special preparation of the seed before sowing? If yes, what preparation?
40. Is it considered important to often change the seed, and to get it from another locality?
41. Have you known instances of spring cultivation or horse-hoeing of winter wheat? If yes, with what results in enlarged production?
42. Is it common to use the roller in the spring on lands where the wheat is liable to winter-kill?

HARVESTING WHEAT AND PREPARATION FOR MARKET.

43. At what date did the wheat harvest of 1879 begin?
When was it at its height?
When did it end?
44. What proportion was cut by hand, and what by machine?
45. When cut by hand, what is an average day's work for cutting?
For binding and putting into shocks?
46. If the work of cutting and putting up is done by gang, how many men in a gang, and what is a day's work?
47. What wages were paid harvest hands in 1879?
48. If cut by machine, what is an average day's work for one man, team, and machine?
49. How many additional hands are required to rake, bind, and put into shock where this is done?
50. What proportion is not bound into sheaves at all?
51. If the work is done by gang, how many hands in a gang, and what is their average day's work?
52. What proportion of the crop is stacked or put into barns before thrashing, and what proportion is thrashed in the field, or directly from it?
53. What proportion is thrashed by horse-power, and what by steam?
Are the machines mostly owned on the farms, or do they travel from farm to farm for custom?

54. What is the usual price per bushel for thrashing wheat?
At this rate, does the grower furnish—
a. Board of thrasher's men?
b. What number of additional hands, if any?
55. What do you consider a good day's work for a steam thrasher under good conditions?
Please state the conditions, the number of men employed, and the amount thrashed.
56. What may be considered the average cost of hauling the wheat from the farm to the market or place of shipment (say, cost per 100 bushels for a given number of miles, as the roads usually are when the grain is shipped)?

DISEASES, INSECTS, MISHAPS.

57. To what extent was the crop of 1879 damaged by smut?
58. Was this more, or less, than usual?
59. Was this more prevalent on upland or on lowland?
60. To what extent was the wheat crop of 1879 damaged by rust or mildew?
61. Was this more, or less, than usual?
62. On what lands, soils, or exposures was the disease most prevalent?
63. Did some varieties of wheat suffer more than others; and if so, which suffered most, and which least?
64. To what extent was the wheat crop of 1879 damaged by insects?
65. What insects did the damage, if any?
66. What remedies have been used against insects, and with what success?
67. Does injury to the wheat crop by insects in your region seriously affect or modify the character of the farming, or act as a preventive against cultivating the crop?
68. Was the wheat crop of 1879 damaged by winter-killing; and if so, to what extent?
69. Was this more, or less, than usual?
70. Did any other mishaps damage or diminish the wheat crop in your region?
71. What weeds are the most troublesome to the wheat crop of your region? And do they damage the crop by choking its growth, or by the seeds mingling with the grain?
72. What means are taken to remedy the trouble?

C.—Maize, or Indian Corn.

73. How does the *yield of corn per acre* in 1879 compare with that of 1878?
With that of 1877?
74. How does it compare in *quality* with the crop of 1878?
With that of 1877?
75. What is considered a fair and what a good yield in your locality?
76. What was the largest yield per acre in 1879 in your locality?
77. What varieties of corn are most cultivated?

PREPARATION OF THE SOIL FOR CORN.

78. How deep is the soil usually plowed for corn?
79. What preparation of the soil, other than plowing, is usually practiced?
80. What proportion of the acreage of the corn crop of 1879 had any manure applied to the crop?
81. What fertilizers, if any, are used, other than farm-yard manure?

PLANTING.

82. What proportion is planted by hand, and what proportion by drill, machine, or planter?
83. How much seed per acre is used?
84. When planted by hand, what is an average day's work per man?
85. When by machine, what per day by man, horse, and machine?
86. What proportion is planted in hills in rows both ways, so as to be tilled between the rows both ways?
And what proportion in drills or rows but one way?
87. When in rows both ways, what is the usual distance apart?
88. What the distance when in rows but one way?
89. What proportion of the seed-corn is selected in the ear by hand, and what has no special selection?
90. Is any preparation of the seed (such as soaking or using solutions) usually practiced?
91. When seed is brought from another locality, is it less liable to succeed if brought from one direction (as from the east, for instance) than if brought from another direction?

TILLAGE DURING GROWTH.

92. If both plow and cultivator (or similar implement) are used, how often each?
93. If the plow only is used, how often usually, and how deep is it run?
94. If the cultivator alone is used, how often?
95. What proportion of the crop is not hoed at all?
What proportion is hoed but once?
What proportion more than once?
96. What are the most troublesome weeds?
97. What is the common height of the stalks when mature?
98. What proportion of the crop is "topped" (the stalk cut above the ears) before it is ripe?

HARVESTING, SHELLING, MARKETING.

99. What proportion of the corn is cut up before husking?
What proportion husked on the hill?
What proportion is not husked at all, but is allowed to be harvested by live-stock?
100. When cut up, what is an average day's work for cutting corn?
101. When husked by hand, what is an average day's work in bushels of ears?
102. To what extent are husking machines used, if at all?
103. What proportion of the corn crop of your vicinity is consumed in the locality, and what proportion is shipped?
104. If marketed, what proportion is sold in the ear, and what proportion is shelled?
105. When sold in the ear, is it usually sold by weight or by measure?
106. To what extent is corn sown (or drilled) for fodder?
107. What is considered a fair yield of dry corn-fodder in tons per acre?

DISEASES, INSECTS, AND MISHAPS.

108. To what extent was the corn crop of 1879 damaged (if at all) by smut?
109. Was it damaged by insects? If yes, what insects?
And to what extent?
110. What other mishaps, if any, damaged the corn crop of 1879?

D.—RYE.

111. What varieties of rye are cultivated?
112. Is the crop mostly cultivated for the grain or for the straw?
113. Is rye grown for forage?
a. For winter pasture?
b. For soiling?
114. What was the yield of straw per acre in 1879?
115. How was the straw marketed, and at what price?
Loose, in bulk, per ton.
In bundles, per bundle.
In bales, per bale.

E.—OATS.

116. How does the *yield of oats per acre* of 1879 compare with that of 1878?
With that of 1877?
117. How does the *quality* and weight of the crop of 1879 compare with that of 1878?
With that of 1877?
118. What is the range of weight per measured bushel of the crop of 1879?
Lightest (in pounds): ; average: ; heaviest:
119. Was the heaviest from seed produced in your locality, or was it from seed which was grown elsewhere?
120. To what extent are seed oats brought from other localities?
121. If there is any considerable importation of seed oats in your locality, where are they brought from?
122. What (if any) is the excess in weight or yield between oats grown from seed brought from elsewhere over oats grown from seed which has been cultivated for several years in your locality?
123. Are more oats grown in your region than are consumed there?
124. What proportion of the oats is fed out unthrashed?
125. What are the customary rules about selling as regards weight? Does the farmer sell by weight or by measure; and if by weight, at how many pounds per bushel?
126. Did the crop of 1879 suffer damage from smut, disease, insects, or other mishaps; and if so, to what extent?
127. What mishaps, if any, is the crop most subject to in your locality?
128. What varieties, if any, are unaffected or least injured by "rust"?

F.—BARLEY.

129. How did the *average yield per acre* of the barley crop of 1879 compare with that of 1878?
With that of 1877?
130. How did the *quality* (in weight and color) compare with that of 1878?
With that of 1877?
131. What varieties are most cultivated?
132. On what kind of soils was the crop most successful?
133. What was the average weight of 2-rowed barley of the crop of 1879?
Of 6-rowed barley?
134. What proportion of the crop is shipped, and what proportion is fed to animals?
135. When shipped, where is it shipped to?
136. Is the crop grown to any considerable extent for fodder?
137. If yes, is it usually cut green, or is it allowed to ripen?

G.—BUCKWHEAT.

138. How did the *yield of buckwheat per acre* in 1879 compare with the crop of 1878?
How with that of 1877?
139. What varieties of buckwheat are most grown?
140. What is considered a fair or good crop?
141. At what date is the crop usually sown in your locality?
142. What mishaps, if any, damaged the crop of 1879, and to what extent?
143. What mishaps is the crop most subject to in your locality?

(*Signature:*)
(*Post-office address:*)

GENERAL QUESTIONS.

Questions 1 to 13 of the special schedule were general. The answers brought out in a strong light the fact that most of the grain produced in the United States is grown in mixed farming, where at least several crops or products are produced on the same farm.

To question 6, "What is the average value per acre of the grain farms of your region?" about five hundred answers were received. The prices ranged much higher in the northern states than in the south. In all of the principal older grain-growing states the average was above $30 per acre, a very large proportion being above that. Where there was any collateral evidence, such as the estimates of boards of agriculture, the discrepancy between the two was not great. For obvious reasons, as a whole, the older the state the higher the value, the average value of lands in Connecticut and Massachusetts, and even in Vermont, being returned higher than in the fertile states of Iowa, Minnesota, or Wisconsin. The question of cheap grain production in the United States is not so much one of cheap lands as it is of freedom of cultivation and facilities for transportation.

To question 7, "What proportion of the grain farms are managed by their owners, and what by tenants?" there was a very large number of answers, the sum of which was that in all of the greater grain-growing states, except in Pennsylvania, more than four-fifths of the grain farms are farmed by their owners.

This estimate is confirmed as a whole by the preliminary count of the farms, their size and tenure (published in *Census Bulletin No.* 279), although in some states the figures may fall below the special schedule estimates. It is very probable, however, in the light of all our present knowledge, that not less than 80, and probably more than 85 per cent. of the total grain produced in the United States, one year with another, is grown on farms which are occupied and managed by their owners, and that of the remainder a considerable portion is grown upon farms only temporarily rented for the year, or on very short lease, during a temporary absence of the owner, or during the settlement of estates of deceased persons, the minority of orphan children, etc.

The greater portion of the grain of the United States is grown upon farms of over 100 acres, and essentially all of it on farms of over 20 acres (only corn being grown upon farms of less than 20 acres, the total amount thus produced being relatively too small to affect generalizations based on the gross production), and the proportion of rentals decreases relatively as the size of the farms increases.

The following table, based upon the bulletin above cited, shows the number and tenure of farms and the relations of size to tenure in a few of the chief grain-growing states used as types. The nine states chosen for the calculations occupy a broad geographical belt, stretching across the midst of the chief grain-growing portion of the country, and embrace both older and newer states. They together produced 68.2 per cent. of the total grain crop of the country in 1879, and their gross number of farms in 1880 (as per bulletin cited) is 1,754,417, of which 1,358,181, or 77.4 per cent., were occupied by their owners. The states are arranged in geographical order, from west and north to east and south.

TABLE XXVI.—NUMBER, SIZE, AND TENURE OF FARMS.

States.	Gross number of farms.	Occupied by owner.	Per cent. of farms occupied by owner.	Per cent. of farms under 20 acres.	Per cent. of farms under 20 acres occupied by owner.	Per cent. of farms over 20 acres.	Per cent. of farms over 20 acres occupied by owner.	Per cent. of farms over 100 acres.	Per cent. of farms over 100 acres occupied by owner.
Nebraska	63,387	51,963	82.0	1.6	64.3	98.4	82.3	66.7	82.0
Kansas	138,561	115,910	83.7	2.0	62.6	98.0	84.1	51.4	83.6
Iowa	185,351	141,177	76.2	2.7	74.1	97.3	76.2	52.8	76.2
Missouri	215,575	156,703	72.7	5.7	36.8	94.3	70.6	47.1	72.7
Illinois	255,741	175,497	68.6	4.9	58.1	95.1	69.2	47.1	68.6
Indiana	194,013	147,063	76.3	6.6	66.6	93.4	77.0	38.0	76.2
Ohio	247,189	199,502	80.7	10.2	81.6	89.8	80.6	38.1	80.7
New York	241,058	201,186	83.4	13.3	88.0	86.7	82.3	40.6	83.4
Pennsylvania	213,542	168,181	78.8	14.6	84.3	85.4	78.8	37.5	78.7

In answer to question 8, "What proportion of the hired labor of the grain farms is hired by the month or year?" it would seem that of the aggregate labor much more was employed by the month or by the year than by the day. But the answers returned from the different regions, even contiguous counties, were so very conflicting that any detailed statement of the relative numbers employed either way would be of little value. In this same connection, question 9 showed that in the grain regions a vast majority of the hired laborers board with their employers.

The answers to question 12, "Is there any one system of rotation of crops generally practiced; and if so, what is the rotation?" strongly emphasize the fact that in the settlement of a new region there is at first no rotation whatever practiced. The wants of the settler, the facilities for cultivation, and the markets determine what crops shall be grown. In a prairie region but very few kinds of crops are cultivated at first to any extent, and these usually corn and wheat.

In a few years (usually about twelve to fifteen years, as indicated by answers to question 13, taken in connection with the others) more kinds of crops are grown, and they succeed each other in a sort of system or rotation, which becomes more and more definite, until in the older states a rotation of crops, so called, is usually practiced. This is not followed with that strictness which marks English farming; but even where it cannot strictly be called a "rotation", there is nevertheless a certain succession of crops which the conditions of the locality or the experience of the individual farmer indicate as the best. Oats follow corn more often than other spring crops do; corn and wheat follow clover more often than oats or barley do. Customs vary greatly, and while we rarely have such strict rotations as the English have, nevertheless the same philosophical principles are used in a more flexible way. The effect of this flexibility will be discussed again, and will be seen incidentally in several connections in this report.

A number of the special schedule questions asked with special reference to some one crop are of general application. The cost of plowing for wheat with average day's work would not differ from the cost of plowing for any other crop.

Question 26, "What is the price per acre for contract plowing: (*a*) breaking prairie; (*b*) breaking meadow or pasture sod; (*c*) breaking stubble or fallow land?" was variously answered, many answering it literally, and many others, particularly in districts where but little plowing was done by contract, answering apparently as to what they considered the cost of plowing to the farmer who does it himself. It was not easy to separate these two. When plowing is done by the acre, there are so many ways in which it may be done that the question may be very variously answered. It may mean that everything is furnished by the man who takes the contract, or he may have board for his team but not for himself, or his team and himself may be boarded, conditions of time may come in, and so on. We may say, however, that in the grain regions breaking sod costs on the average from $1 50 to $2 per acre, $1 50 being more often returned from Ohio and westward, and stubble from 75 cents to $1 50; that in the newer prairie states the breaking of new prairie is usually from $2 to $3 per acre, $2 50 being the most common price returned, many answering as low as $2, and nearly as many others as high as $3. Above $3 is comparatively rare, but in places it rises to $4. Below $2 is still more rare, but sometimes the cost sinks as low as $1 50. These differences are in part due to the different nature of the original prairie sod in different sections, in some of which the sod is much tougher than in others, and in part are due to special conditions in 1879. If in one place the land was drier than usual, then the breaking of prairie for that year would cost a little more than it would if in the best condition for breaking.

When farmers do the work themselves, as is usually the case, the estimates vary greatly, not only because of the actual difference of cost arising from different conditions, but because of the difference in the way in which the work is estimated by different men. When a man plows on contract, at a given price per acre, he expects to make some profit by his labor. Some farmers, estimating the cost of plowing which they do for themselves, count what it would cost them to hire it done; others put it lower, saying that the profit, if any, is not cost. Then, again, cost differs much in different years or in different parts of the same year. A drought coming at a season when the plowing should be done may increase the cost 20, 50, or 100 per cent. This work being so correlated to the rest on the farm that many farmers find it hard to estimate the actual cost to them, there is, of necessity, considerable latitude in the figures returned.

We may sum this up in a general way by saying that the returns for Illinois, Iowa, Missouri, Nebraska, and Minnesota place the breaking of original prairie by contract at from $2 to $4 per acre, $2 50 per acre being the most common price; that the breaking of sod usually runs from $1 to $2 per acre, $1 50 being perhaps the most common price, and for stubble or fallow $1 to $1 25 are more often returned than any other prices. In Indiana, Michigan, and Kansas the prices range, as a whole, a little lower, perhaps about 25 cents per acre. In New York and New England prices are higher, the breaking of sod being estimated at from $2 to $3 50 per acre, and stubble from $1 25 to $2. The stonier character of the soil is probably the principal reason for this. Throughout the South prices vary as in the North, and would apparently average about the same. The figures gathered by commissioners in Canada and in the states during the past two years agree with those here given.

To question 25, "What is an average day's work for man and team in plowing?" in New England, and east of the Alleghany mountains generally, an acre is more often returned than any other amount, although an acre and a half is quite common. Two acres, however, is rare. In western New York, Ohio, Michigan, Kentucky, Tennessee, and similar localities, an acre and a half is returned more often than any other amount, two acres not being uncommon, above two acres being rather rare. From Ohio westward through the prairie region two acres is returned more often than any other amount, two and a half not being at all uncommon, and below one and a half rather rare. In California and in portions of the prairie region, where plowing is done with gang-plows and larger teams, the amount of plowing represented by one man's work is much larger, in portions of California one man and eight horses plowing six, eight, or even ten acres per day.

Questions 52 and 53, relating to the thrashing of wheat, apply equally well to the thrashing of other grain crops, except in so far as it relates to the cost per bushel. We may say in a general way that nearly all of the grain of the United States is thrashed by machines not owned by the farmers themselves, which travel from farm to farm and thrash at a specified rate per bushel or for a certain portion of the grain. In all of the greatest grain-growing states most of the thrashing is done by steam; it is probable that not more than 20 per cent. of the entire crop of wheat is thrashed by horse-power, and a not much larger portion of the oats and barley.

Most of this thrashing is done by itinerant machines, only the largest farmers owning their own machines. Twenty years ago, when most of the machines were worked by horse-power, a much larger proportion of the farmers had their own machines than now. The prices charged will be noticed when considering wheat.

It is only on a few of the largest farms, where machines are owned, that thrashing is done directly from the shock, and inasmuch as it is mostly done by custom machines, it cannot all, or even the most of it, be done during the time of harvest, and nearly all the grain has to be protected from the weather, by stacking or housing until it is thrashed, everywhere east of the great plains.

In California most of the grain is thrashed directly from the header. If it is stacked, the stack is merely a pile made for convenience, without reference to protection, as good weather may be relied upon during several months of the summer season. In regions of scant fuel, straw-burning engines are becoming common; but in the eastern United States, where straw has more value, they are comparatively rare.

Question 56, relating to the cost of hauling wheat to market, is general in its application, and is discussed fully under the head of transportation and handling.

Questions 71 and 96, relating to what kinds of weeds are most troublesome, elicited but little information which need be considered here.

ESTIMATING THE COST OF GRAIN PRODUCTION.

The cost of production of grain has long been a subject of much study and speculation. Because of the new features introduced into agricultural competition by modern methods of transportation, this constantly recurring question is assuming fresh importance, and has lately been made the subject of new investigation by individuals, organizations, and official commissions. The results of such investigations thus far are no more satisfactory than those made earlier, when different conditions of competition prevailed. They agree only in their most general conclusions; in nearly everything that regards details, even the most important, there is much conflicting statement and discrepancy of estimate. The causes for this are incidentally discussed elsewhere, but need to be noticed here, before the discussion of the special grain crops, for a general understanding why the special inquiries have not better answered this question. The introduction of labor-saving machines so largely into farming has brought this industry in its business aspects nearer to that of the manufacturing industries than heretofore, and it has become common to assume that the same principles underlie production in both, and that the cost of the production of grain crops is as susceptible of accurate calculation as is the cost of manufactured articles.

Although the two classes of industries now more closely resemble each other than formerly, they nevertheless remain as unlike in the principles of production as ever, and the uncertainties of the estimates alluded to are inherent to the vocation. In manufactures everything used is bought in the markets; all the buyers fare essentially alike, the most of the processes are under control, and we can predict the results beforehand. Therefore the cost of each manufactured article can be closely calculated before the thing is made.

This is not true of anything produced in agriculture. In certain phases of farming we can accurately give the cost of the product after it has been produced, but we cannot predict beforehand what it will cost. On a large Dakota wheat farm, or on a California wheat ranch, where the farmer grows but a single kind of crop, buying everything he uses in his business and paying for it with the proceeds of that one crop, the problem is simple, and the cost and profit or loss on that crop can be accurately stated after it is sold. If but two kinds of crop are grown, it may not be possible to state the actual cost of each separately, but still it can be closely approximated. The fewer the kinds of products grown on any grain farm, the nearer we can calculate what each one has cost, and along with this the business becomes more speculative in character. When the cultivation is reduced to but a single kind of grain crop, although the profit and loss on that crop can be ascertained, yet its growth is speculative, because the yield depends upon conditions beyond control, and cannot be predicted when the expense is incurred.

With mixed farming all this is very different. The profits are never so high as they may be with a single crop in the very best of years, but the greater the variety of production, within reasonable limits, the fewer the liabilities of absolute failure, and, correlated with this, the more difficult it becomes to calculate the cost of any one separately, except in a general way and for a considerable term of years.

It is in mixed farming that agriculture differs most widely from manufactures. Agriculture is so adaptive that it cannot be destroyed; manufactures can. The country may have excellent natural facilities for manufacturing, and yet hostile laws or established and organized competition may utterly prevent such industries from starting, or kill them if already in operation. Not so with agriculture. If the natural conditions are favorable, nothing can kill it short of exterminating the inhabitants. If the country retains a civilized population, no matter how hostile the laws, how sharp the competition, or what its nature is, this industry will go on in some shape. Mixed farming is so perfectly plastic that it molds itself to each surrounding pressure, adapting itself to any imposed conditions, and if in intelligent hands and perfectly free it will go on profitably.

We see this strikingly illustrated in the present aspects of New England agriculture, which, under the pressure of western competition, has adapted its methods and its products to this pressure and has gone on prosperously, the production per hand employed being larger, and the capital engaged in the business greater per hand employed, than in most states of the more fertile West. Moreover, the actual value of the product is increasing year by year.

The success of mixed farming depends upon this adaptability, and the profits of each farmer must be measured by the general result of his business, as a whole, for a number of years, rather than by the success of any one crop for any one, or even two or three years. No crop is profitable every year; each fails from time to time; and so the profitableness of any one can only be determined from the results of a series of years. A farmer in New York, Pennsylvania, Ohio, or Illinois, who grows three or four cereals, has green crops as well as grain crops; raises some cattle, hogs, sheep, and horses; has poultry, an orchard, and a garden; whose sons work in the field while the wife and daughters work in the house, finds it practically impossible to tell exactly how cheaply he can grow wheat or corn from the experience of any one, two, or three years, although he may have a general idea of the cost as a whole; and when from any cause a crop becomes unprofitable, whether from changes in the soil, new liabilities to accident, or change in the markets, he drops it out of cultivation. But this change comes about gradually, and, owing to the adaptive nature of the vocation, he slowly changes his crops and his methods, and thus the business, as a whole, goes on successfully. The different crops are so correlated, and the nature of the industry is such, that the cost of each one separately cannot be specially stated, nearer than to say that during a series of years the cost of production has been a little less than the average market price of that crop in that place during those years. The actual cost of each one varies from year to year, considered by the acre, and still more so by the bushel, and each year probably some one has cost more than its selling value. If for any cause one crop becomes unusually remunerative in any place, its cultivation rapidly extends, until prices fall or lands increase in value and a new equilibrium is restored; if, on the other hand, it becomes unprofitable, it drops out of cultivation only after it has been demonstrated by the experience of a number of years that neither directly nor indirectly does its cultivation pay as a whole. But this never takes place suddenly, because no one or two or three years can settle the question, and in any region of mixed farming the relative areas put into the several crops are continually adjusting and readjusting themselves to each other.

Grain production in New York may be used as an illustration, because that is an old state, its agriculture continues prosperous, and grain-raising, on the whole, is on the increase, notwithstanding the competition with the more easily tilled grain regions of the West. If in any district insects become so destructive to the wheat that its cultivation becomes especially uncertain, the crop diminishes in that district; and when the insects diminish, then the cultivation of wheat again increases, continually readjusting itself to the conditions of the farm and the conditions of the market.

The following table of the cereal productions of New York at each decennial census is inserted to illustrate how there may be a general progress in such a state in the face of continued and increasing competition with other regions having in many respects superior facilities. In the table the crops are divided into two groups, the more important first; but with each group there is a progress toward greater production as a whole, although the individual crops fluctuate. We know, as a matter of fact, that notwithstanding western competition, bad years, and so on, the industry, as a whole, in this state has been prosperous during those years, and the farmers as a class have gained in wealth, although it has been more difficult for the farmers to state the actual cost of their crops separately than for the farmers of the more exclusively grain-growing regions to state the cost of their crops:

TABLE XXVII.—CEREAL CROPS OF NEW YORK.

Variety.	Crop of 1879.	Crop of 1869.	Crop of 1859.	Crop of 1849.	Crop of 1839.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Corn	25,875,480	16,462,825	20,061,049	17,858,400	10,972,286
Wheat	11,587,766	12,178,462	8,681,105	13,121,498	12,286,418
Oats	37,575,506	35,293,625	35,175,134	26,552,814	20,675,847
Total of the three	75,038,752	63,934,912	63,917,288	57,532,712	43,914,551
Barley	7,792,062	7,434,621	4,186,668	3,585,059	2,520,068
Rye	2,634,690	2,478,125	4,786,905	4,148,182	2,979,323
Buckwheat	4,461,200	3,904,030	5,126,307	3,183,955	2,287,885
Total of the three	14,887,952	13,816,776	14,098,880	10,917,196	7,787,276
Total grain	89,926,704	77,751,688	78,017,168	68,449,908	51,701,827

In discussing the questions relating to the modern competition between English and American farmers too much stress is usually laid upon the relative cost of the separate items in the two countries and too little upon the differences of methods and conditions of production. The American farmer is free to adapt his methods and his production to any external condition that may arise, and so soon as he pleases; the English farmer is not. England and America represent two extremes as to methods and conditions in several respects. In no other country is there so complete and so universal a separation into three classes of those who own the soil, or the landlords, those who supply the necessary capital and direct the cultivation, the farmers, and those who do the labor, as there. It almost invariably happens in England that the land-owners, the farmers, and the farm-laborers represent three distinct classes economically, and in a measure socially, and the relations between them are analogous to those which exist between the buyer and the seller. The American farmer represents the English landlord, farmer, and farm-laborer all in one man. As a landlord, he has complete control of his land and can make such permanent improvements—draining, planting orchards, erecting buildings, or what not—as he thinks will pay in the long run; he has also entire control as to what crops shall be grown, when they shall be grown, and what their succession or rotation shall be, and what shall be sold from the farm. As a farmer, he can pursue such methods of culture as seem best at the time, without being restricted by a lease made years before, and when the conditions of competition were different. Nor is he restrained by local tradition and unwritten law. In short, he can freely modify his methods and his crops to suit varying conditions just as rapidly as seems best to him; the English farmer cannot. In England the ownership of land confers many social privileges, and this gives land a value it would not possess for merely agricultural purposes. In America it is on a level with any other kind of property, and is associated with no special, social, or political privileges; it is merely capital, and nothing else. Most English farmers on rented farms are not free to adapt their crops and methods to new conditions suddenly imposed except by special concessions by the landlord; the American farmer may as freely adapt his business to varying conditions of markets as a manufacturer does. Then, again, the labor problem is entirely unlike in the two countries. The majority of American farmers are also laborers themselves; so there is a wider distribution of the profits of production, and the highest incentive to faithful work. It is, however, in the entire freedom of the American farmer to modify his crops, his methods, and his sales, as the varying seasons and markets may indicate, that the most of his advantage lies, and this is of special value in times of unusual and unexpected drawbacks, as, for example, in the bad seasons which have lately visited England and brought such sore distress on her farmers. In all such cases the loss by bad crops or poorer prices does not fall equally upon the three classes immediately interested, either in time or in force. It is felt first by the farmer, who has his rent to pay in any case, whose capital is in his temporary lease and in the personal property to stock the farm. If the trouble is temporary, the loss falls chiefly upon him; if permanent, he may be ruined before the landlord on one side and the laborer on the other get their share of the burden. During the time required for an adjustment of the business to the new conditions he may be crushed by the pressure. The American farmer in such cases turns himself easier under the load. The adjustment of losses between the capital in real estate, the personal property of the farm, and the laborer, takes place at once and together; the three interests bear each their just share; and if the trouble is a permanent one, the business immediately adapts itself to the new conditions, and goes on accordingly. Moreover, he is not compelled to farm on so intense a scale, and the relative losses from bad seasons are therefore usually not so intense.

At the risk of being tedious, other illustrations may be cited to show the practical impossibility of giving the precise data as to the cost of each separate crop in mixed agriculture. The failure to do it is often and popularly attributed to the "lack of business training", to "loose ways of conducting business", etc., by those who have had only theoretical experience in farming. The real difficulty lies in the correlation of the crops. We cannot tell how much of labor, of manure, or expense actually goes to each crop, and, consequently, two neighboring farmers, both successful men in their business, may make very different estimates of the relative cost of raising a given kind of crop, and yet come to the same general conclusion in the end as to whether it will pay to continue its cultivation.

For example, the farm-yard manure is hauled upon a corn-field, and if the cost of this be charged to the corn crop, then the crop which follows the corn, and which actually shares in the benefits of the manure, gets undue advantage in the estimate of the cost of its production.

Again, two very different crops may be cultivated on the same soil, as, for example, a grain crop in an orchard, in which the cultivation of the ground for the benefit of the apple trees is one of the objects in growing the grain, and the estimated relative value of each of these would depend entirely upon the individual whim of the cultivator.

Again, it often happens that a minor crop is cultivated where the direct ledger account, year by year, would not show it directly profitable, and yet it may be so related to other crops, or to some want of the farm, that it is of indirect value in average years, and in exceptional years fills an important place. On most farms some crops are put in with the feeling that in ordinary years they will not more than pay expenses—planted with somewhat of the same feeling that a man insures his house from loss by fire. In ordinary years insurance premium is money out and no return. Taking insurers as a body, it costs more in the long run to insure than is received in case of accident; and yet without insurance there is a risk incurred which a prudent man feels he cannot afford to run.

Again, during most of our history as a country, and especially during the last thirty years, most of the grain farms have been rising in value. In the newer sections of the country a farmer going on cheap lands, did he merely live by his live-stock and his crops, still might acquire wealth by the rise in the value of his lands. This most important element is left out in nearly all the estimates of cost and profit in grain production. In a new country the profits arising from this are for a time equal to those which result from the crops themselves. Every farmer is familiar with examples where men have purchased land at one, five, or ten dollars per acre, lived off its produce, reared their children, made perhaps but limited profit from their crops more than was put into improvements on the land, but meanwhile their farms have risen in value ten, twenty, it may be several hundred per cent.

Again, the relative exemption of crops from accident and casualty is another item whose value can only be determined from the experience of a series of years. This factor, so often lost sight of in making estimates of cost, is really so important that it may determine the whole agricultural character of a country, and is one reason why we cannot predict whether the growing of any crop in an untried region will be successful for any considerable number of years or not. That question can only be settled by the test of actual experience, because so many conditions are involved over which the cultivator has either no control whatever, or but partial control, and the results of which he cannot foresee. Success in one year is no proof of reasonably permanent success, and the cost of production of any crop in any particular year is but a poor indication of the average cost of that crop for any considerable number of years. A rich bottom land may produce large crops three years out of four or nine out of ten, and then be liable to total loss from floods; another region of reasonable fertility may be exempt from locust plagues five years out of six or twelve out of thirteen, and then may come total loss; and so of other accidents. In all popular attempts at estimating the cost of production such accidents are often left entirely out of the question, although upon them depends much of the ultimate prosperity of the agriculture of the region.

Again, the influence of the crops on each other and on the land cannot be accurately estimated. Precisely how much this crop affects the one which is to follow, or how long such cropping can be maintained without exhausting the land, are matters of uncertainty.

Again, cost varies with the intensity of production. On all ordinary farms "it pays to farm better" up to certain limits; this passed, increased production is only secured at an unprofitable expenditure. To illustrate my meaning: A certain grade and style of farming on a given farm may result in an average produce of, say, sixteen bushels of wheat per acre, and this amount may be grown with profit. With more care, more manure, and better tillage it might be made to produce twenty bushels per acre—an increase of 25 per cent. in the crop at less than 25 per cent. additional expense. If we continue to increase the production by still greater care, the expense increases faster than the product does, and a limit is soon reached, beyond which it does not pay to go; but each district, almost each farm, is a law unto itself in this matter. The farmer feels his way, the limit depending much upon the sagacity of the farmer himself. This principle further complicates the already complicated relationship existing between the different crops, and explains why, in many districts, crops may appear to yield very small returns and yet farming go on prosperously. There may be great breadth of land, and the farming not be on an "intense" scale, even if the very best appliances be used. For example, a very large farmer in southern California told me he could well afford to grow wheat with an average of eight or nine bushels per acre. He has an enormous breadth of land, bought cheaply and easily tilled; he plows with the most improved gang-plows, a single man plowing 10 acres per day; he cuts with 12½-foot headers, thrashes with straw-burning steam thrashers; rains in summer are unknown, so that if the crop be but grown there is no fear of loss from bad weather in harvest. In a similar way grain is grown over great regions east, where the yield is small per acre, and yet, in the main, it "pays" as a factor in mixed farming, but here the cost of the special crop is not so susceptible of calculation.

Again, the cash value of the waste material, and the way in which it is utilized, makes much difference. The straw may be sold off the farm, as it often is in the vicinity of towns, or used for manure on the farm or for feeding. What its value is to the farmer, if used on the farm, is a matter of uncertainty, and would be very differently estimated by different farmers. And so on through a long list of intimately correlated factors, each of which is variable or uncertain, and all of which are susceptible of different estimates as to value.

The vagueness of statements, the conflicting estimates, the uncertainties of cost, therefore, are inherent in the business. It is practically impossible to estimate the cost of separate crops more exactly than in the general way indicated. Where the cost of separate items can be stated, they will be in their respective places.

MISHAPS TO CROPS.

In any grain-growing country the more important mishaps to which the grain crops are liable are caused by the uncertainties of climate, by diseases, and by insects. Other special dangers occur, incident to the locality, flood here and fire there; but the three causes I have spoken of are the real limiting conditions in most grain-growing countries, or, if not the absolutely limiting conditions, at least are very important restraining factors, and over neither of them have we more than very partial control.

The mishaps due to the uncertainties of climate are those that come from unusual and extreme droughts, extreme wet, storms, and, in the case of winter crops, winter-killing. We say in a general way that we have no control over any of these, and in farming on a large scale, and where reliance is placed for success and profit on but one or two crops, this is absolutely true. Drought, wet weather, storms, or insects destroying these, destroy all the income of the year. But with mixed farming, conducted on a smaller scale, although the conditions are not under control, the loss may be mitigated. More careful and deeper culture diminishes the loss by drought; the growth of different crops is not simultaneous, and hence drought, unless very extensive and long continued, will not pinch all alike. The harvests of the different crops occur in different months, so that an ill-timed storm or period of wet weather which may destroy or injure one crop may do little or no damage to another. The farmer who is not at work on too extensive a scale, and who cultivates a variety of crops, adapts his work to the seasons so far as possible, and thus the most is made of the conditions that are favorable, and the unfavorable ones are restricted in the damage they may do.

My own belief is that herein is the largest factor in the success of the agriculture of the grain-growing portions of the United States. This freedom of action on the part of the farmer, combined with the intelligence to use it profitably; the perfect liberty to conduct his farming operations, either as to crops, methods, sales, or improvements, as sudden or temporary exigencies of climate or market or as various mishaps may render advisable, gives him a great advantage over the farmer who has but limited freedom of action as to crops and methods.

As meteorology acquires more and more the features of an exact science, we may confidently hope that agriculture may more and more profit by it, possibly being able to avert some of the worst evils which come from the uncertainty of the seasons. The United States weather signal service is already of immense importance to American agriculture, paying for itself many times over in this industry alone.

The diseases to which cereals are subjected, so far as we know, are due entirely to parasitic fungi. These diseases may be divided into three classes: the smuts, which affect the grain; the rusts, blights, and mildews, which affect the stalk, foliage, and vegetative portions of the plant; and a third class, practically unknown in this country, which attack the roots. Regarding the treatment of these, they will be specially mentioned under the crops, so far as any treatment is valuable. We will only say here that the blights, rusts, and mildews, while primarily caused by parasitic fungi, are nevertheless intimately related to the climate.

Respecting mishaps by insects, the experience of this country has been peculiar. The continent of America, as a whole, is especially rich in insect life—a fact remarked by farmer and naturalist alike from the time of the first explorations. In addition to those insects which were native here, and which learned early to attack our crops, of which the potato beetle, the chinch-bug, and the Rocky Mountain locust are familiar cases, others came here from the Old World, emigrating with men, as weeds do, or came along with the armies of the Revolutionary War, and, like other immigrants, finding here a new field for their energy and enterprise, have thriven and grown in the New World as they never did at home. Of such the Hessian fly is a most illustrious example.

This last class of mishaps has controlled and limited the culture of some grains, curtailing production very greatly in certain regions, and science is doing what it can to mitigate their ravages. Entomologists employed by governments, both central and state, have thrown much light on the matter, and if we ever practically get control over them it must be from the studies and suggestions of scientific men.

I am indebted to Professor C. V. Riley, of the Department of Agriculture, for memoranda relating to the insects which prey upon the several grain crops, with references to the literature of the more important ones and suggestions regarding the treatment. These will appear in their proper places under the separate grains.

The number of official publications in this country pertaining to insects injurious to our crops is so large, several of the more distinctive insects having special treatises devoted to them, that I have thought it best not to treat of them here further than was necessary to enable the reader to understand the general bearings of the subject and to assist the farmer to apply the most approved remedies, giving references complete enough to enable any one desiring to make special inquiries easily to find the most accessible and reliable literature relating to each species.